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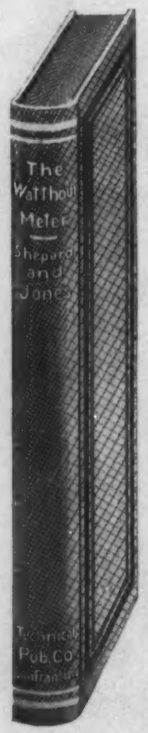

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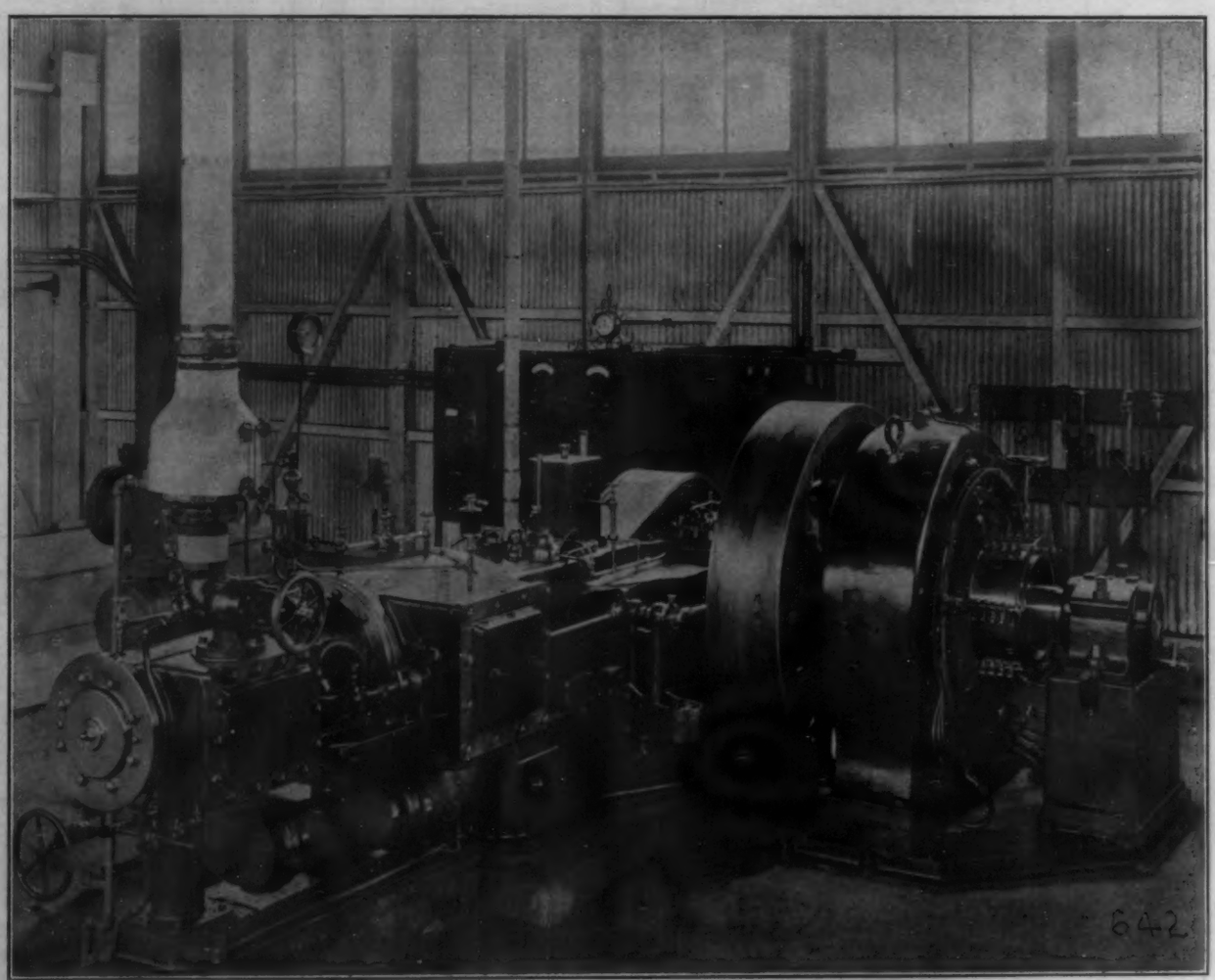
MOTOR DRIVE IN THE DOW PUMP WORKS

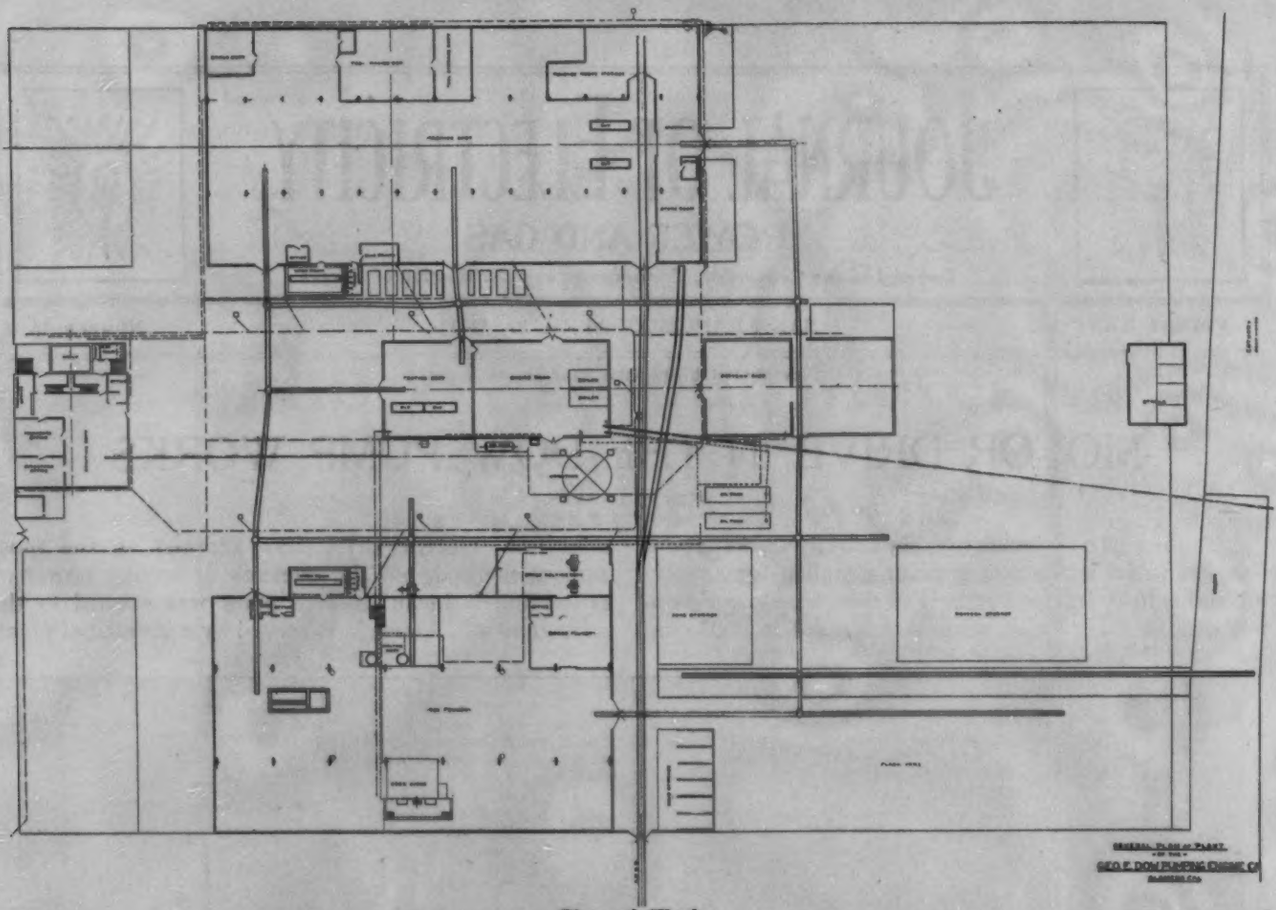
BY J. W. SWAREN

Among the noteworthy industrial works about San Francisco is the power plant installed for supplying light, heat and power to The Geo. E. Dow Pumping Engine Co. These shops are housed in well constructed corrugated iron buildings on the banks of the Alameda estuary, and have deep water and rail shipping facilities.

When the erection of new shops was under consideration, electric drive was adopted as the most modern method, but the question of buying power or generating it in an isolated plant was opened to the management. Alameda is served by a municipal plant, and no competition in the sale of electricity is permitted. The rates offered for loads similar in character to the load of a general machine shop did not seem attractive when compared with the possibilities



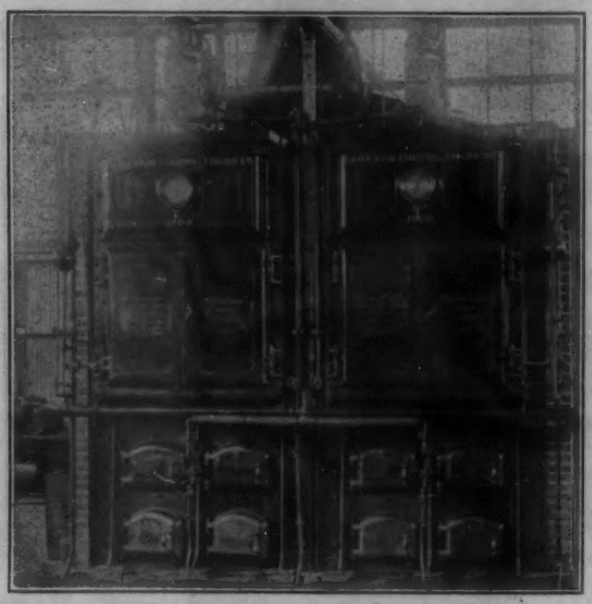
Engine, Generator and Switchboard Supplying Power for the Dow Pump Works.



Plan of Works.

of power generated in their own plant. This was particularly true as steam for testing purposes would be needed under any arrangement. The judgment of the engineers responsible for this plant has been sustained in practice.

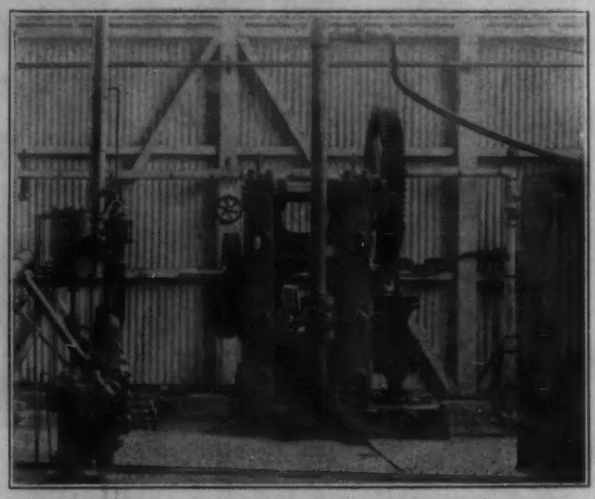
The power house, a building 50x120 ft., is placed near the geometrical center of the factory, and as the machine shop is on one side, foundry at the other, with office and pattern shop at the ends and testing room under the same roof, the load center is practically co-incident with the geometrical center.



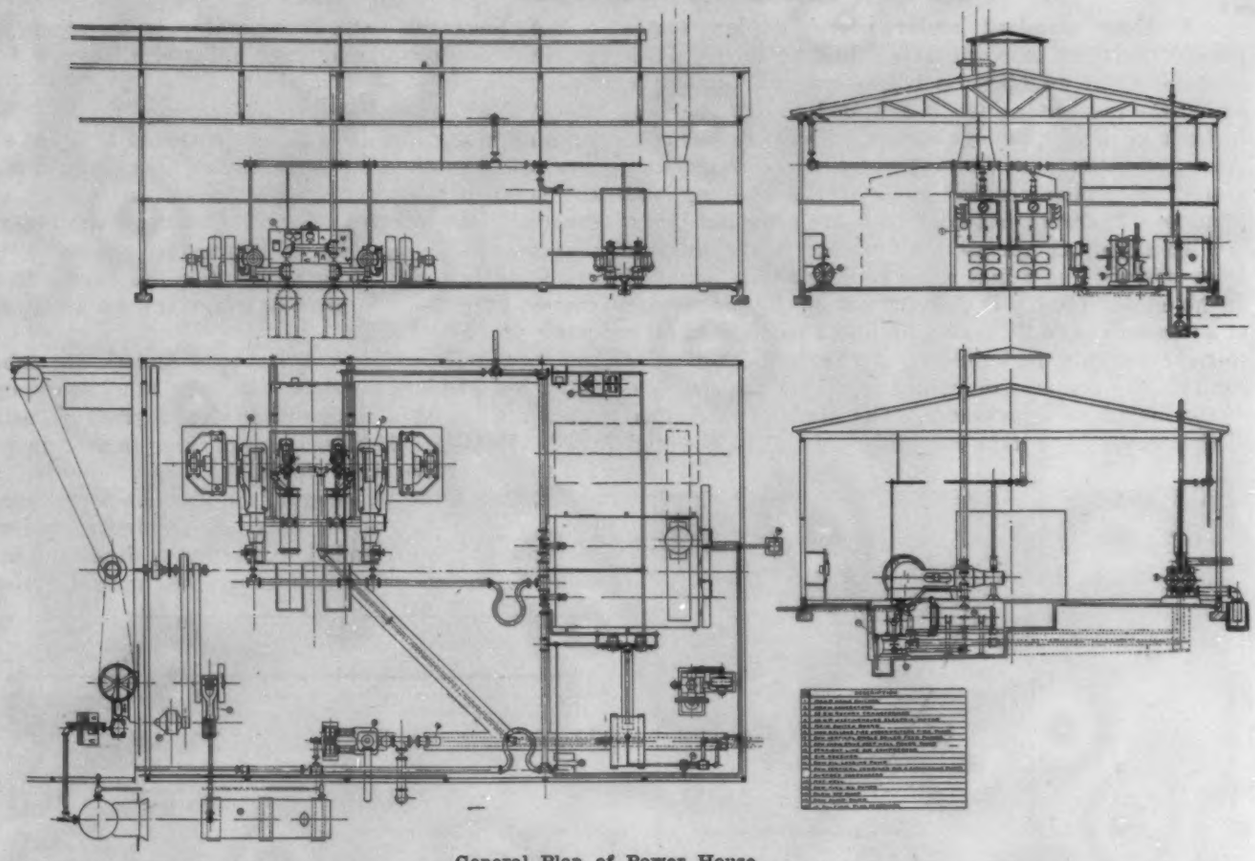
Boilers.

The engine room, which contains all pumps and boilers as well, is 50x70 ft., with concrete floors. Two Heine safety water tube boilers, rated at 100 h.p. each are installed. They have 65 tubes 3½ in. diameter and 16 ft. long, and steam drums 36 in. diameter 18¾ ft. long. Saturated steam, at a pressure of 150 lb. is delivered.

Crude oil is used for fuel and is stored in two tanks, each with a capacity of 12,560 gallons, set on concrete piers outside, and 40 ft. from the building. The oil flows by gravity to the oil set. It is received



Oil Pumps, Filter Tank and Artesian Well Engine.



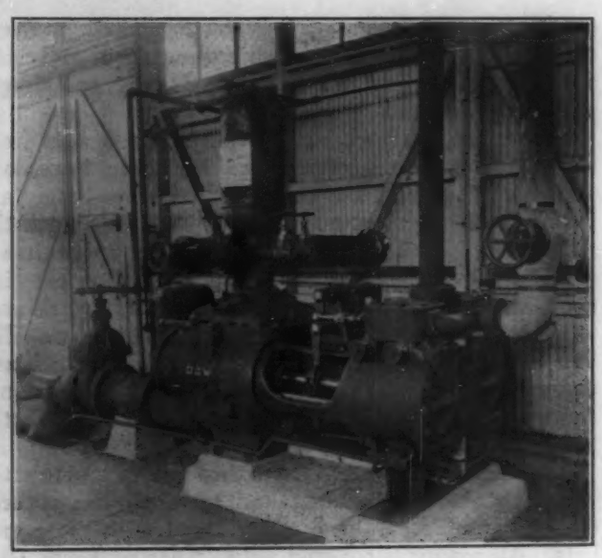
General Plan of Power House.

in tank cars and a Dow oil fitted 6x6x6 in. duplex pump is used for unloading. The oil burning system consists of a standard Staples and Pfieffer set equipped with two Dow 4½x2¾x4 in. oil fitted duplex pumps. The quantity of oil consumed is metered. The meter is connected between the pumps and heater, thus measuring the oil cold.

The auxiliaries exhaust into a filter box which serves as a hot well, receiving the condensed water from the engine condensers. Feed water, at a temperature of 150 degrees F. is taken from the hot well by two Dow marine type vertical single piston feed pumps, 6½x4¼x10 in. These pumps are fitted with removable bronze lined cylinders, bronze pistons and bronze valves, and the steam and water connections are made to manifolds, permitting of the fullest flexibility in handling.

The main water supply comes from a bored well, having a diameter of 14 in. and 200 ft. deep, drilled under the engine room floor, near the boilers. A Dow power driven artesian well engine, with an 18 in. stroke operates a Dow bucket plunger pattern deep well cylinder, with 7⅜ in. bucket, and 5½ in. plunger, placed 190 ft. below the floor. Water at the rate of 80 gallons per minute is delivered by this pump to a tank 115 ft. above the ground level. This tank has a capacity of 30,000 gallons, and is supported on a structural steel tower. The base of this tower is 30x30 ft. and the corner posts rest on concrete piers, 4x4 at the top and 8x8 at the base, and sunk 8 ft. in the ground.

The deep well pump is motor driven through a silent chain drive. A 13 h.p. Westinghouse motor, controlled by an automatic starter operated by a float switch in the tank, is mounted on a special sub-base. The sub-base of the motor and the base of the pump are connected by a distance piece made from a piece of 6 in. extra heavy pipe, 10 in. long, with flanges on both ends. These flanges, are in turn bolted to the respective bases, the whole forming a compact, inexpensive and rigid subbase of sufficient size to accommodate the silent chain.

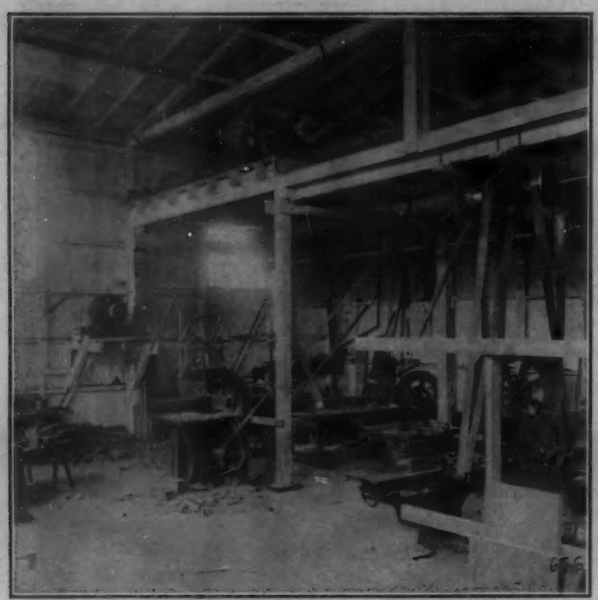


Fire Pump.

A cast iron pipe, 14 in. in diameter, with lead caulked joints runs from the engine room to the estuary, 320 ft. away. This supplies salt water for condensing purposes and fire protection.

A Dow standard underwriters' duplex steam pump, 18x10x12 in. with a capacity of 1000 gallons per minute at 70 r.p.m. is connected directly to the end of the salt water line. A Y branch in this line, just in front of the fire pump connection, provides for condenser connections. The fire pump is connected to a system of piping extending about the building and numerous hydrants and hose reels are provided.

To supply compressed air for use in the shops a Dow straight line radial valve compressor is installed in the engine room. It delivers 400 cu. ft. per minute at a pressure of 80 lb. per sq. in. into a receiver 54 in. x 16 ft. set outside the building. An automatic unloader controls the compressor, which is driven by a 40 h.p. motor belted to a jackshaft. The starting resistance of this motor is of the open grid type and is mounted



General View of Pattern Shop.

on the engine room wall. The jackshaft projects through the partition between engine room and testing room providing a means for driving centrifugal pumps during test.

The boilers are connected to a steam header from which the steam is distributed by three lines, one 6 in. line leading to the testing room immediately adjacent to the engine room; a 6 in. line is carried over the engine to which it is connected by a long radius bend; and the third line leads to the machine shop erecting floor, where it supplies steam for testing machinery too heavy for test in the regular testing room. The line leading to the engine is terminated by a blank flange, a provision for a future unit, for which foundations are already built. The fire pump is connected to the testing room line.

Flanged fittings are used throughout, corrugated copper gaskets being installed. Up to the present time no trouble has been experienced with these gaskets. All piping is covered with 85 per cent magnesia one inch thick.

To provide for expansion and contraction in the piping system copper, U shaped expansion joints are installed on the testing room and engine lines, while roller hangers are used throughout.

A Swartout vertical separator is installed just above the throttle and effectually removes all condensation.

A Ball tandem compound engine, 10x18x16 in., running at 250 r.p.m. is direct connected to a 100 kw. 250 volt, Westinghouse generator. The engine is of the semi-enclosed type, with Sweet valve gear and standard Ball inertia governor. A combination splash and gravity oiling system is used; a pump in the crank pit lifting oil to a tank above the engine to be carried by gravity to main bearings and back into the crank pit.

The high and low pressure cylinders are lubricated by standard condensation type lubricators, cylinder oil having a flash test of 600 degrees F. being used. Metallic self lubricating packing is used in piston rod and valve stem glands.

Between the two engine foundations a condenser pit is sunk. At present only one condenser, a Dow surface type, is installed, room for a duplicate unit being provided. This condenser has brass U tubes,

General View of Foundry.

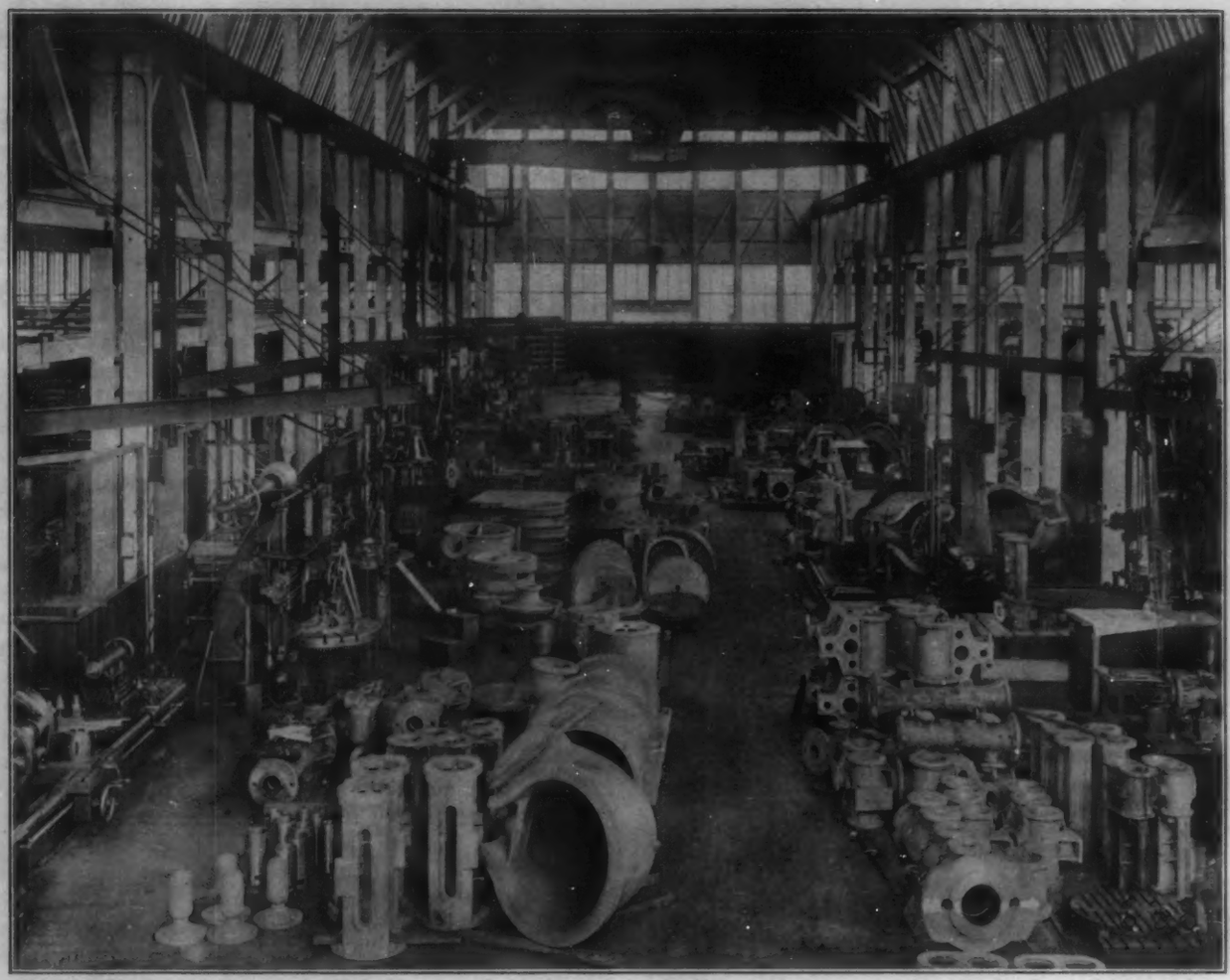
with a total area of 400 sq. ft. A niche is cut in the engine room floor so that the tubes can be readily withdrawn. Salt water at an average temperature of 70 degrees F. is drawn from the fire line, and a vacuum of 26 in. with barometer reading 30 in. is readily maintained when condensing 1900 lb. of steam per hour.

A Dow twin vertical combined air and circulating pump is installed. This pump has a steam cylinder 8 in. diameter, air cylinder 12 in. diameter, circulating cylinder 8 in. diameter, with a 10 in. stroke.

To handle sumpage, a Dow duplex pump, 3x2x3 in. exhausting into the main condenser, is mounted on a bracket fastened to the condenser pit wall.

The generator is the standard direct current engine type mounted on separate subbase, with outboard pedestal bearing. The main leads are carried in conduit under the floor to the switchboard.

The switchboard has five panels of black slate. The first panel is intended for a future unit, but at present is utilized for a meter panel, carrying a 600 amp. 221-250 volt G. E. astatic type watthour meter. The second panel is used as a generator panel for the present unit, having a three-pole switch for main and equalizer leads, automatic circuit breaker, voltmeter, voltmeter plugs, pilot lamp and ammeter. The



General View of Machine Shop.

third panel is used for controlling the motor-generator and city service. It has the necessary switches for controlling the generator of the motor generator, and two d.p.d.t. switches for throwing the office lights from the main bus bars to the city service. The fourth panel is used as a power and lighting distribution panel, controlling the lights for foundry, and machine shop, motors for foundry, foundry blower, pattern shop and engine room. None of these circuits are equipped with automatic circuit breakers. The fifth panel is also used as a distribution panel. It has a switch controlling the machine shop motor circuit, and automatic circuit breakers on the circuits supplying foundry crane and machine shop crane, and a third breaker on the leads from the generator of the motor generator set.

As a provision for overtime work in offices and shops, standby service is purchased from the Alameda municipal lines. The distribution on these lines being two-phase sixty cycle alternating current at 220 volts, a motor generator set is required. A standard Westinghouse 25 h.p., 220 volt, two-phase CCL motor, running 1120 r.p.m. is direct connected on the same bedplate to a Westinghouse 20 kw., 250 volt direct current generator. The auto transformer and motor control switches are mounted on a pipe frame, slate panel, board near the motor generator set.

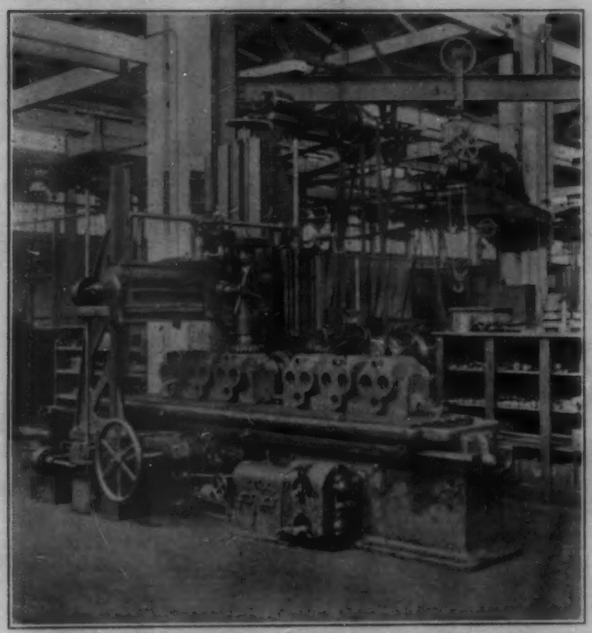
The economy obtained in this plant is quite good when all the factors governing it are taken into consideration. Daily performance shows 85 kw. hrs. per bbl. of oil, while the load factor is only 45 per cent measured against a nine-hour day. This is equivalent at a load factor of 17 per cent measured against a 24-hour day. Large excess capacity, both in engines and boilers, is required for testing purposes, although under normal conditions fires are maintained under one boiler only.

The machine shop building is arranged in three bays, the middle bay being covered by a monitor roof, and spanned by a ten-ton high speed Shaw crane. Light machine and tool work is done in the side bays, the heavy machine tools being arranged along the sides of the main bay so as to be served by the crane. The erecting floor is in this bay as well.

Both the group and individual systems of machine drive are in use. The individual drives are generally equipped with variable speed motors, and in some instances as many as three motors are used on one machine. Where the group system of driving is employed, the motors are mounted on a bracket designed and made in the shops.

In the foundry the moulding floor is spanned by two ten-ton cranes, with a bridge of 48 ft. The moulding machines are pneumatically operated, while tumbling barrels and other machinery are driven on the group plan. For serving the charging floor of the

cupolas a 4000 lb. pneumatic elevator is installed outside the building. A reducing valve is installed on the testing room line to supply steam to the indirect system of heating installed in the office building. The heating coils and blowers are installed in the basement of this building.



Motor Driven Milling Machine, Showing Post Bracket Motor Mounting in Back Ground.

Tungsten lamps are installed in the machine shop and foundry, while carbon lamps are used in office and engine room.

Of more than passing interest to engineers is the drafting room on the first floor of the office building. It is situated on the north side of the building, and

Three Motors on Machine No. 122.

one large sheet of glass forms the north wall. This gives an excellent diffused light throughout the room, which has tables accommodating 12 men. On the second floor a complete blue printing room is fitted with every convenience, including a Cooper-Hewitt electric blue printing machine, sun frames and washing conveniences.

The entire plant was designed and erection supervised by Mr. W. H. Dow, works manager, to whom the writer is indebted for the information contained in this article. The tests from which the data regarding operation were taken, were made, by Mr. R. F. Chevalier, consulting engineer for operation.

RECLAMATION OF THE ARID WEST.[1]

BY FREDERICK H. NEWELL.[2]

The benefits derived by applying science to industry and the still greater benefits that may be expected when all great problems are attacked in the scientific spirit and on the scientific methods are to a certain extent exemplified by the opportunities afforded and results now accomplished in the conservation of the natural resources of the Nation.

The reclamation of the arid West is simply one of a number of items of national importance upon whose correct solution by true scientific methods rests largely, not merely the material prosperity of the Nation, but, more than this, the perpetuation of free government, and of high standards in individual liberty.

The stability of a republic or democracy, whichever we may term it, rests not upon its wealth, but upon the character of the individual citizen and voter. The greatest commonwealths are not necessarily those having the greatest natural resources, but rather those in which the human units are strong. The strength of the unit, the family or the voter, is not derived from material wealth, but from ability to act and think independently and to exercise that intelligent self-interest which binds him to the great mass of his fellow men. If, for example, he is working in a factory or on a railroad line, he is, of course, interested in keeping his job. Beyond this, he has little concern with the condition of municipal, State or Federal affairs. These are entirely too remote to touch him, and if he lives in a tenement, he has no concern beyond paying his rent and getting the most he can for it.

But take this man, indifferent to forms or details of government, and put him upon a 40-acre farm. Assuming that he has reasonable industry and intelligence, his whole view point of life changes. He is transformed from being more or less of a nomad, shifting from flat to flat, or from town to town, and indifferent to the general welfare. He now becomes a landowning citizen and voter, interested in every public movement for better roads, better schools, better local government, and everything which leads up to the stability of the institutions of the State as upon these rest the value and comfort of his home.

This thought has been most pithily embodied in a statement attributed to Edward Everett Hale where he asks "whoever heard of a man shouldering his musket to fight for his boarding house?"

The problem of the reclamation of the arid west is being attacked primarily for the purpose, not of mak-

[1]Presented before the Congress of Technology at the Fiftieth Anniversary of the Granting of the Charter of the Massachusetts Institute of Technology.

[2]Director, U. S. Reclamation Service, Washington, D. C.

ing men rich, but of strengthening the foundations of the State. It is an attempt being made by the Federal Government almost at the eleventh hour of its opportunities to utilize the waste resources still remaining at its command, and to employ these in such a way as to strengthen local communities and states, and to create in the more remote parts of the country many prosperous communities composed of independent, landowning citizens, each family being resident upon a farm sufficient for its support, and cultivating the soil intensively, under favorable conditions of sunlight and of water supply, such as to produce the largest crop yield per acre, and to bring about the largest individual success.

The people thus placed upon the farms are not merely producers. They not only raise enough to support themselves, and to sell to their neighbors, but indirectly they stimulate all industries. They are large consumers, as well as producers, and it may be said that for every family placed upon an irrigated farm on the desert, there arises the possibility of another family engaged in transportation or in manufacturing in the East or Middle West. All parts of the country are thus linked together. The success of the irrigator in the West means larger cotton production in the South, more boots made in Massachusetts, more freight and passenger cars hauled across the continent.

The success already attained in applying scientific methods to this great problem of conservation of the waste resources of the country may be attributable in part at least to the Institute of Technology, and to the instruction there given.

With a comprehensive and reasonably accurate review of the conditions to be met, it is then possible to bring to the solution of the problem the principles and methods of engineering and to put into play the constructive ideas which are inseparable with a technologic education.

The constructive faculty, the ability to imagine or to picture desirable results, and to turn these into accomplishment by scientific methods is the foundation for success in these larger lines of work.

In the matter under consideration Congress in 1888 authorized an investigation of the extent to which the arid lands might be reclaimed. This problem is enormous and its correct solution is fundamental to the future growth and development of the Nation, because of the fact that one-third of its area is arid. In that third are potentially some of the most valuable lands in the world.

The problem is to obtain water for these lands. This in turn rests upon questions of economics and engineering, in storage of flood or other waste waters, and in the adjustment of a form of agriculture suited to these conditions. The results already attained show that the lands are not only capable of supporting a large population, but under Government auspices many thousands of families have been settled in prosperous homes and a highly desirable class of citizenship has been created in a most sparsely populated part of the country.

As a natural outgrowth of the investigation begun in 1888, the so-called Reclamation Act of June 17, 1902, was passed, setting aside the proceeds from the disposal of public lands for the construction of works for the reclamation by irrigation of the arid and semi-arid lands. It has been held that Congress has absolute control over the public lands and of the funds arising from their disposal, and while it might be questionable as to whether the United States could levy taxes, and thus raise money for reclamation, it has been considered that Congress could properly create a trust fund derived from the source named. This fund has amounted to over $60,000,000, and is being added to at the rate of six or seven millions a year. It has been invested in the construction of reservoirs, canals, and distributing systems, and already 27 projects have been initiated or completed, works having been undertaken in each of the Western States and Territories.

Over a million acres have been reclaimed, and 14,000 families are receiving water from works built or controlled by the Government, under the terms of this Act. Reservoirs have been built having a capacity of nearly 5,000,000 acre-feet, that is to say, the water would cover 5,000,000 acres to a depth of one foot. Canals of large size, carrying over 800 cubic feet per second, have been built for a total length of 300 miles, and somewhat smaller canals constructed with a length of a thousand miles including the ditches. There are over 5000 miles of water courses, also nearly 70 tunnels with a total length of about 20 miles. The smaller structures number over 20,000 including bridges, culverts, headgates, siphons, etc. Nearly 60,000,000 cubic yards of earth have been excavated and 10,000,000 of loose and solid rock.

The principal results, however, are shown in the crop production and although the works are hardly built to a point further than to try out portions. It appears that the value of the crops raised in 1910 was nearly $20,000,000, and land-values have advanced from practically nothing to one hundred million dollars. These values will continue to increase as the works near completion.

The object, however, as before stated, is not to make men rich, but to make homes for citizens who will preserve the institutions of the country, and to do this without imposing a burden upon the taxpayers. It has been shown how this is being accomplished by the use of the Reclamation Fund, which is revolving and growing larger and larger, that is to say, as the money comes back from the works completed, it is used over again and is being increased by additions from the disposal of other public lands. Under wise administration the funds should increase and produce larger and larger results in the conservation of the waste waters and the utilization of these in those parts of the United States where rain is infrequent and where the brilliant sunshine can be depended upon nearly every day in the year. It is really the sunlight which is capitalized and made valuable.

The question is frequently asked, why should not the Government reclaim the worthless lands in the East? The answer lies largely in the fact that no other part of the country than the arid West has such wonderful opportunities for crop production, as it does not have the continuous daily sunshine upon which plant life depends. The advantages of the development in the arid region also are greater from the political standpoint, as population is better distributed and is brought nearer to important source of mineral wealth, enabling development of industries in otherwise remote and inaccessible localities.

CONSTRUCTION OF THE TIETON CANAL.

The description of the Tieton canal, built in Central Washington by the Reclamation Service, before the American Society of Civil Engineers, should be most interesting in illustrating a new method which has been worked out to fulfill conditions of rapid flow, a comparatively long canal, a steep and rugged hillside and withal a permanent work fulfilling requirements at a minimum of cost. It was necessary to bring water 14 miles from a diversion in the Tieton River, through a canyon in which all of the problems confronting the Western engineer had to be met and solved. The side of the canyon presented a slope of 60 per cent and the ground formation of clay shales and uncertain rock surface, placed any but a permanent and self contained canal out of the question. It was decided to build a reinforced concrete flume having a circular section, entirely self-contained, i. e. not to be dependent upon outside earth pressure or structure to compensate for the spreading effect of the internal water pressure, furthermore to be capable of sustaining earth pressure from the exterior as from slides or fallen trees and lastly to cause as little disturbance of the ground surface as possible. The difficulty was complicated by the lack of concrete materials near the flume line. It was decided to build the flume in short sections which would dovetail together and be finally joined by cementing. At several flat points, convenient for raw materials, yards were cleared and the sections were molded. These, when properly cured, were hoisted onto specially made wagons and loaded onto car trucks which ran on temporary track laid along the line of canal. By a special placing device they were rapidly and accurately placed in position and cemented. A backfilling of earth was then made for support from underneath.

The wetted area of this canal is 36 sq. ft., the coefficient of roughness in Kutters formula was taken to be 0.012 and the resulting flow of 326 sec. ft., having a velocity of 9.05 ft. per second. The cost of making the concrete forms, hauling and placing, including all overhead expense but not including trenching or placing the ground in condition for receiving the flume, was, $5.80 per linear foot. The paper does not give the results of tests of capacity flow, as, at that time there was not sufficient water in the river to fill the flume, but while some curious and unexpected actions where the direction of flow was sharply changed, have been noted, the method of construction in short sections with cemented joints apparently has little deprecatory effect.

A comparison of costs with open earth canal is interesting. Providing that, in the judgment of the engineer, a section of earth canal is advisable, upon completion there need be little surprise in finding cracks or other breaks, due to blasting or the nature of soil beneath the surface which will need rebuilding or constant repairing after operation. Furthermore the coefficient in Kutters formula may range from 0.02 to 0.03 necessitating a wet cross section that may be double that required to carry the same quantity of water in the concrete flume. Where this work may be done with a steam shovel, the cost per linear foot may range as low as $4.00, but if there is much rock and the locality is more or less inaccessible, the cost may easily range to $6.00 or $7.00.

Flume of the steel type supported on timber structure, which has been adopted by the Reclamation Service in some Rocky Mountain sections, to carry the quantity of water that the Tieton canal is designed for will cost as high as $8.00 per linear foot.

The cost of benching for the sectional concrete flume should be no more than that of constructing a mountain road and in most cases should not be over $1.00 per foot and in no case over $2.00. This would make the total cost of this construction, using the latter figure, $7.80 per foot which compares favorably with the other methods mentioned, with the advantage that the cost of depreciation and maintenance are reduced to a minimum.

In the Tieton project are a number of tunnels lined with sections placed in the same manner as is the flume. The tunnel sections have, however, a circular closed section. For localities where the cost of building and forming the lining in place is not a preventative factor this method of lining might not have an advantage. In this instance the lining, exclusive of the cost of driving the tunnel, cost in place, $8.35 per linear foot.

One tunnel of 3000 ft. of this project, having a hard self-supporting basaltic formation, was lined in the usual way, by building floor and sides of concrete, leaving the natural rock roof. It was found that this construction cost even more than the sectional ring lining which could be used through any formation, proving at least in this case that the new method is not only an improvement in construction but in cost over the form methods of building tunnel linings.

CHIMNEY FORMULA.[1]

BY W. F. DURAND.

In connection with Mr. Dunn's paper on chimney capacities, the accompanying formulae may be submitted as representing conservative practice under what may be denominated approximately normal operating conditions. The factors which enter into the problem of chimney draft and capacity are so numerous, their relations so obscure and values so difficult of numerical determination, that of necessity all chimney formulae are empirical—that is, they are simply practice expressed in algebraic form. The literature of engineering abounds in chimney formulae, but inasmuch as most of them relate to coal burning practice, I have ventured to add one more to the list and intended to refer strictly to oil burning practice.

While as noted all chimney formulae are empirical in character, yet they may to some extent be made rational in form, and the more nearly such condition is realized the better will the formula take care of variations in the operative conditions, outside the immediate range from which the empirical factors are drawn.

The general character of a chimney formula on rational lines may be readily developed, as follows: The function of draft involves the pushing of air into the furnace and the pushing of the gases of combus-

[1]Paper presented at San Francisco meeting American Society of Mechanical Engineers, March 10, 1911.

tion through the tube spaces and then up the stack to the outer air. This involves the work of giving kinetic energy to a body of air and gas and of moving it against a resistance. In general such work will depend on the quantity of gas moved and on the square of the velocity. This work must be supplied by the draft head or difference of pressure between the external air and minimum pressure within the boiler, and per pound the work will be measured by the difference of pressure in pounds per square foot multiplied by the volume of one pound of gas in cubic feet. We have thus in general the relation: $u^2 \backsim VP$ when u = velocity, V = vol. per pound, P = draft head measured in pounds per sq. ft.

Again, let B = boiler horsepower, w = pounds of gas per boiler horsepower, A = area of chimney, then BwV = total volume of gas = Au.

But $u \backsim VP$, and P the draft head will depend in general on the height of the stack and on the stack temperature. According to simple theory of stack draft, such head is measured by the difference in weight between a column of normal air and a column of hot gas each of the height of the chimney.

In any event, we may put $P \backsim hx$ where h = height of chimney and x = a factor or term depending on the temperature.

We have then: $u \backsim \sqrt{Vhx}$ and hence $A\sqrt{Vhx} \backsim BwV$ whence $A\sqrt{h} \backsim Bw\sqrt{\frac{V}{x}}$

In words, the product of the area by the square root of the height should follow closely the product of the number of pounds of gas by the square root of the volume per pound and divided by the square root of the function x.

But the volume of one pound of gas V varies directly as the absolute temperature. This of course varies widely between the furnace and the top of the stack. The temperature at the base of the stack is usually taken, however, as primarily related to the value of the draft function x, and for convenience we may use the same temperature as related in a general way to the value of V.

Also w, the pounds of gas per boiler horsepower, will vary inversely as the boiler efficiency.

Let e denote the efficiency. Then we may write

$$A\sqrt{h} = \frac{B}{Qe}\sqrt{\frac{T_s}{x}}$$

where Q is the general constant or factor.

The function x takes the form $\frac{A}{T_a} - \frac{B}{T_s}$

where A and B are constants and T_a and T_s are absolute temperatures of the air and of the stack. Where draft head d is expressed in inches of water and the height of the chimney in feet, this takes the form

$$d = \left(\frac{7.6}{T_a} - \frac{7.9}{T_s}\right)$$

If 80 degrees Fah. is taken as a fair upper temperature of the air, this reduces to

$$d = \left(.1407 - \frac{7.9}{T_s}\right)$$

The entire square root $\sqrt{\frac{T_s}{x}}$ is therefore a function of the temperature and its value for a range of values of T_s is given in the accompanying table.

TABLE.

VALUE OF TEMPERATURE FUNCTIONS.

t	v
400	4.19
420	4.16
440	4.12
460	4.10
480	4.07
500	4.05
520	4.04
540	4.03
560	4.02
580	4.01
600	4.00
620	4.00
640	4.00
660	4.00
680	4.00
700	4.00

It now only remains to find a value for the numercial constant Q. This has been done by using the results of practice and thus checking the formula against the indications of experience.

In this manner, we find as follows:

$$(A - a)\sqrt{h} = \frac{By}{Qe}$$

where A = area of chimney in sq. ft. a = small constant area as below; h = height in feet; B = boiler horsepower actually developed, which equals number of pounds of total evaporation per hour reduced to conditions from and at 212 deg., divided by 34.5; c = boiler efficiency; y = temperature factor from the table; Q = coefficient.

a and Q have values as follows:

For large chimneys or from 300 b.h.p. up

$$a = 2.5 \quad Q = 54$$

For small chimneys or from 500 h.p. down

$$a = .6 \quad Q = 40$$

In choosing the values of these constants Q the following special conditions are assumed:

Heat value of oil fuel.....about 18,500 B.t.u.
Temperature of external air.....80 deg. F.
Excess of air in furnace, about.....100 per cent

Boilers working at rate of output not greatly exceeding rated load.

The particular numerical factors in the formula are perhaps not so important. I dare say further investigation—undoubtedly the results of Mr. Weymouth's data might change the numerical factors. I believe however that the form of the formula may possibly be of some aid in passing from one set of conditions to another, or interpolating between various sets of conditions; and that is about all any engineering formula can hope to do.

DISCUSSION AT SAN FRANCISCO MEETING A. S. M. E.

Atomization of Fuel Oil.[1]

W. F. Durand: In connection with the paper by Mr. Hunt on atomization, I have been interested in estimating the work equivalent of this process. The nozzle of a burner is a more or less effective device for transforming energy of steam into jet energy, exactly in the same manner as does the nozzle of a steam turbine. The atomization of the oil and its projection at high velocity into the furnace involve the expenditure of work, and this work must be derived from the steam by way of the nozzle.

One-half pound of steam per pound of oil is perhaps a fairly representative figure for the amount of steam required. This amount of steam used with any reasonable nozzle efficiency and under the conditions of say 90 pounds initial pressure absolute and 15 terminal, should develop from 35,000 to 40,000 ft. lb. of energy, thus expended in work on the oil. This figure is impressive. It is probable that due to wire drawing and inefficiency in the nozzle the amount of work actually utilized is less than this figure. In any event, however, the price paid for the preparation and introduction of the oil into the furnace is a heavy one, and the question not unnaturally arises as to whether or not this can be the ultimate method. May not some method be developed, mechanical or otherwise, which shall enable us to do the necessary amount of work on the oil without the heavy expenditure involved in the present systems of steam or air atomization. Mechanical atomization seems to present some possibilities and it may be that the future development may lie along this path. In any event, I feel that as engineers we should entertain a feeling of profound discontent with our present methods of preparing and introducing the oil into the furnace, and that we should not rest until either some less costly method is developed, or every possible method and expedient has been given a thorough trial.

Thos. Morrin: With a view to seconding Professor Durand's last statement (although I was not aware that he was going to take up that subject) I wish to read a few notes: The use of crude oil as fuel has been developed along the lines of unlimited extravagance in the vaporizing process, and has been perpetuated from one scheme to the other in the same line of application and operation.

Until recently the prevailing land practice has been to use a steam jet from the boiler at full pressure to vaporize the oil at the burner tips, for the simple reason of its convenience and its low cost of application. This is perhaps the most expensive method for accomplishing this object. Some types of burners requiring much less vaporizing medium than others, but none of them are economical, and all of them susceptible of great waste, limited only by the size of steam connections and the pressure of that medium.

I believe that these conditions cannot be materially changed, except by providing a burner mechanism that will require air only at an extremely low pressure that may be furnished at a minimum cost, so that its most extravagant use could never exceed a certain fixed range.

Here I beg to take exception to that part of Mr. Hunt's paper in which the form of the burner is referred to as of minor importance, as I am convinced that it has considerable to do with preparing the oil for satisfactory combustion, inasmuch as it is necessary to vaporize the oil or work it up into minute atoms the method of accomplishing this atomization must necessarily depend to a great extent on the burner.

I have in mind what might be called mechanical burners; inasmuch as they are of the rotating or of the turbine fan wheel type, rotating at a high speed and delivering the oil from the periphery of the burner at a velocity approximately 7100 ft. per minute, equal to an air pressure of approximately 1½ ounces per square inch.

In tests made as to the quantity of oil and the percentage of power used to burn a fixed quantity it was noted that the energy expended to accomplish this result was less than 1 per cent. In fact, the figures showed an actual consumption of energy amounting to but 0.6 per cent of the actual heat results of the oil burned. This energy expended not only vaporizes the oil but it delivers the oil and a full quantity of air for complete combustion, which if segregated, would perhaps reduce the actual energy expended for atomizing the oil to less than 0.4 per cent.

Another plant uses 660 pounds of oil per hour with jet burners and air at pressures in two different blasts, while with jet burners of 6 ounces and 6 pounds per square inch, respectively, the volumes are in the proportion of 80 per cent at 6 oz. and 20 per cent at 6 pounds. No reliable data is available on the operation of this plant, but from a careful observation of the plant under full operation and giving the most satisfactory results from the basis of cost and maintenance and the efficient use of the oil, and allowing the highest possible amount for energy consumed in the vaporizing, we get a loss not to exceed 1½ per cent, which if correctly measured and checked up would not exceed 1 per cent of the energy in the oil.

I refer to this scheme of vaporizing oil for the reason that I am sure that oil will be used more and more and also that its application for fuel purposes may be increased if we convince the consumer that it is not necessary to install a steam boiler or an expensive and elaborate mechanical equipment to utilize this kind of fuel. A simple centrifugal blower and a rotary geared pump driven by one electric motor that any unskilled person may use and operate is possible.

The great difference in cost and the much more convenient use of oil fuel as compared with coal, have been so favorable that we have overlooked this feature of the economical application of oil as fuel, until it is now being applied to household uses requiring a simplified apparatus, which can be safely and economically operated by unskilled male and female servants; in fact, fool proof. In this transition the use of air under low pressure has proven a great step forward in the use of oil as fuel.

In this respect the form of furnace is also important. The hearth of the furnaces should be of good fire resisting material, of high radiating efficiency, and thin, with air inlets well diffused over the surface. While it is not necessary to heat the air for the best and most economical utilization of its heat units, it has been proven that oil can be burned in the jet process with much less noise with heated air than with cold air.

This system of vaporizing oil is just as applicable to the service on board ship as it is to the most remote fruit dryer, hop kiln or malt houses, where it would be only necessary to install a small motor and volume blower, with the necessary oil pump, within the prescribed limits of the Underwriters, thereby placing the application of fuel oil without expensive cost to almost any service requiring fuel.

I am satisfied that with this method of vaporizing the oil, less energy per pound of oil burned will be required than in any other form now in use, and it should receive more attention from engineers and consumers than in the past.

These are not new schemes or new ideas, but have been in use to my certain knowledge for six years in San Francisco, but with indifferent success; but recently have been improved to a considerable extent. So much so that their efficiency is far and away ahead of the usual steam or high pressure air method of vaporizing oil.

[1] Journal of Electricity, Power and Gas, Mar. 18, 1911, page 247.

Use of the Orsat Apparatus.

Mr. Bailey: To learn the efficiency of the furnaces in the station of The Municipal Light & Power Co.'s plant in San Francisco, we installed an Orsat apparatus in the fireroom. The four boilers are of Stirling make, and the samples were taken about a foot below the damper. The sampling tube used in each was a piece of ⅜ in. iron pipe, open at the end. Small lead pipes from each furnace were run to a header with a valve in each, so that a sample could readily be taken from any of the furnaces. A small water ejector was connected to the header to insure drawing over a fresh quantity of flue gas before a sample was taken. We experienced trouble with the lead piping from pin-hole air leaks, and from the piping sagging and forming pockets, which trapped water from the products of combustion and prevented a flow of flue gas. These troubles were overcome by the use of ¼ in. iron pipe.

The Orsat determinations were of great value at the start in educating the firemen as to the amount of air required. All of our men were experienced in the burning of fuel oil, but they were firing with from 80 to over 150 per cent excess air. By shutting down on the draft and making frequent determinations with the Orsat apparatus until a high per cent of CO_2 was obtained, the firemen were taught how a fire should appear with the minimum amount of air for complete combustion. We were unable to get much better than 12 per cent CO_2, as above this point the fire is liable to produce smoke, which would not be long tolerated in the neighborhood of our plant.

Although we had no direct means of measuring the economy due to better firing, an increase in kw. hr. per barrel of oil followed at once. The second month we had the Orsat installed, we showed an increase of 19.3 per cent in the kw. hr. per bbl. of oil obtained the month before installing the Orsat. During this period the load factor on the turbine increased from 43 per cent to 53.5 per cent, which would account for some of the increase in economy, but hardly for the amount obtained.

The Orsat apparatus is not a suitable instrument for constant fire room use, as the rubber connections rapidly deteriorate and the glass parts get broken. It is well worth its cost, however, as it will awaken and maintain in the firemen a lively interest in the subject of combustion, which is sure to result in better firing.

In order that the firemen may appreciate the importance of maintaining a high per cent of CO_2, we have posted in the fireroom two curves, one of which gives the relation between per cent of CO_2 and per cent of excess air; the other, the relations between the per cent of excess air, flue temperature, and calculated boiler efficiency.

To measure the oil in our fuel tanks, we run to each a ¼ in. brass pipe, which is run through the top of the tank to a point close to the bottom. To each pipe, at a convenient point in the engine room, a U tube containing mercury is attached. Each pipe is connected to the compressed air system of the plant. To read the height of oil in a tank, the compressed air is turned into the pipe until it blows out the oil which may be standing in the vertical section leading down to the bottom of the tank. The air is then throttled down so that only a small amount escapes through the oil, and a reading taken of the difference in level of the mercury in the U tube.

A scale alongside the U tube can be calibrated by means of known quantity of oil in the tank, so as to read direct the number of barrels contained in the tank at any time. In a tank 13 ft. deep and holding 110 barrels, we can read within a barrel of the true amount in the tank. By inclining the tubes so as to get a longer range of movement of the mercury, greater accuracy could be obtained. Should the gravity of the oil change from that used when calibrating the U tubes, the readings must be corrected for the difference in gravity.

Making Producer Gas from Oil.

J. A. Yeatman: California oil is a heavy oil, and is not freely vaporized. To prepare the oil so that it might be vaporized and burned in a gas engine, experimenters at first used what are known as gas-engine retorts, heated either externally or from the gas engine exhaust. As the California oil contains a deposit of clay or earthy matter which the oil companies were not extracting, the retorts would foul in a short time and become incrusted with carbon and dirt, so that they could not be made to operate continuously. Consequently their use was practically abandoned. In endeavoring to further the use of the heavy oil they took up the gas producers, designed much along the lines of the hard and soft coal producers of the East. But it was found that the percentage of hydrogen was so great, and the creating ignition in the standard gas-engine so troublesome that they had to reduce the compression, and then it often failed to ignite if the proportions were not correct. This was also practically abandoned.

Then Mr. Frost developed the Frost engine producer, which works well but requires gas engines of excessive bore and stroke for a given amount of power, which increases the friction in the engine. The device, while simple to an engineer, is quite complicated to the average small gas-engine user.

There was another producer put on the market in Southern California with which they have had considerable success; but it has its defects because it has a tendency to foul, and when they provide means for overcoming the congestion the gas varies and the results are somewhat problematical.

Some twelve or fourteen years ago I read a lengthy mathematical discussion of the Diesel gas engine and I was convinced at the time that a modification of burning the oil directly in the cylinder would probably be a success; but owing to the high compression required as the matter was then understood, such engines were practically impossible.

In order to use California oil in gas engines it is necessary to extract the residue in the oil. The oil companies have put in centrifugal separators, which leaves the gas engine manufacturer free to operate his gas engine without fouling the cylinders. Most of the ordinary carburetors are based on what is known as the suction principle, and the force is not sufficient to atomize the ordinary 10, 12, 16 and 18 gravity oils. Some gas engine manufacturers have developed an atomizing mechanism, which takes the place of an ordinary suction carburetor; and considerable success has been had along those lines during the past two years. I have been reliably informed by engineers who have observed tests that they have been able to produce a horsepower with .6 lb. California crude oil of 14 gravity by direct atomization after it had been strained by a centrifugal separator. This marks probably the greatest progress towards getting economical power that I know.

The Diesel Engine.

The Chairman: Mr. Yeatman's remarks remind me that we have had almost nothing with reference to the question of the direct combustion of the fuel in the cylinder. It is a subject which in itself might form the topic of an evening's discussion. Why the Diesel motor has never made any stand for itself in this country has always amazed me. There are certain troubles inherent in it, and yet abroad it has been used to a very considerable extent, and even in units of quite considerable size. Here however it has never gained a foothold.

G. H. Marx: Since this topic has come up, it occurs to me that in 1904 I visited the laboratories at Munich, and was shown the engine on which Professor Shroder had performed his experiments, by his assistant, who assured me that at that time they had used California crude petroleum in some of their tests, and that the petroleum had worked satisfactorily, and left no residue in the cylinder.

Howard Stillman: While we are on that subject I would like to make a few remarks covering the operation of Diesel engines. The Southern Pacific Company had one in the Ogden shop, and I made a number of tests with it; and the economical performance of that engine was of course far in excess of anything that we had. It was first exploited as an engine with which we might use the California petroleum oil; and some few attempts were made to operate with California crude oil, but it was an utter failure. The engine would run about five minutes sometimes, and sometimes half a day, and another day the shop was tied up for lack of power. Finally we went to a lighter distillate, and with it it worked well, and was economical in its performance; but even with that oil had its defects. The theory of this engine cannot be excelled, but the personal equation came into it. We could not keep the shop going. The managers tired of making repairs on it. Sometimes we had records of three weeks at a time when the engine's performance was wonderful, and then would come a period of say two weeks when the old steam engine had to be used.

Some time after this, a larger unit was installed at Tucson and was operated for three years. The same attempts were made to use a crude oil, or a lower gravity oil, with it, but it was intermittent in its action. It finally got down to a fuel oil (I think from Texas) of lighter gravity than the California oil, and its performance was fairly good. But it had its difficulties. When it was working it was a splendid machine. I think there were about 300 men in the machine shop and all the power was generated from this Diesel motor, connected with the shop shafting, and the stationary engine that formerly ran the shop was still in place. There was one attempt made to dismantle the steam engine, but fortunately they had only taken off the blocks before the Diesel motor was hung up for repairs. After that they never attempted to discard the reciprocating steam engine, which was fortunate, as we had a number of troubles with that Diesel motor. It was under repair much of the time, and finally we abandoned it. They found there was no net economy in operation, because no one could tell when it was going to stop.

Mr. Fenn: When I was in Chili last year I saw a number of Diesel engines in operation, and inquired particularly about them from the chief engineers in charge. They pronounced them satisfactory, but they were using a Peruvian crude of 34 gravity. When I came back to this country we took up the question of using our oil, and the Diesel company refused to respond for any California oil heavier than 19 degrees.

Mr. Bell: I think the United Verde mine have just purchased a 1000 h.p. unit, without paying any attention to where the oil was coming from. The Associated Company shipped them a light crude. They could not do anything with it, and now we are sending them a sample of oil and distillate of different parts of the fields of California, to try and get that engine to run successfully. It must be in the California oil itself which has this carbonizing effect, that interferes with these engines.

Thos. Morrin: In regard to using crude oil, and the fouling of carburetors I once had occasion to inspect all of the carburetors made in and around this vicinity in the interest of an eastern manufacturer that was producing a large number of gas engines. From my experiments I found it best to use duplicate carburetors and when one fouled to change to the other. By feeding water through the dead carburetor while yet hot, the dirt and carbon would sluff off easily and quickly.

Mr. Fenn: I would like to add one word to what I said, that is, that it is not in the California oils perhaps that the trouble lies, but rather in the gravity, because they are using some of our distillates that are of 31 or 32 gravity. The distillates from our crudes they are using in engines.

Howard Stillman: The oil that we used on the Diesel engine at Tucson had a gravity of about 30 degrees. I should put that limit, about 25 or 30 degrees oil. I would not use under 25 degree oil in the Diesel engine.

The Chairman: The comparison of the distillate with the crude I think is hardly legitimate. It would seem to me that the crude, even though of as high gravity as the distillate, might contain products that would tend to cause fouling; whereas your distillate would be a more uniform product, and with less or no other product in it.

Mr. Fenn: I perhaps misunderstood. I understood him to say that the California distillates had proven unsuccessful up north.

Mr. Bell: No. They tried one of 22 gravity from the Sunset Monarch refinery in Sunset, which proved unsatisfactory. But they are now trying a 30 and 40 gravity, and I do not know with what success at this time.

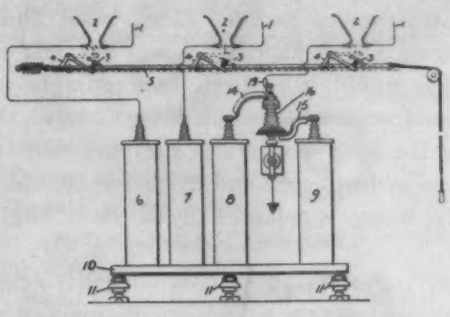
C. R. Weymouth: I would like to second some of Mr. Dyer's remarks about the character of the papers presented, and express the hope that this will not end the session on fuel oil. Personally I am in touch with a large number of Eastern engineers, who are considering in lively fashion the adoption of the use of crude oil by a number of Eastern plants; and I know that our eastern membership looks to the Pacific Coast for information on oil burning. I believe we have quite a number among us who are capable of treating the question of crude oil more explicitly and more generally than it has so far been treated; and before we cease this subject we ought to try to prepare an encyclopaedia on crude oil which will stand for a long time to come, and do credit to our local branch's first attempt. I believe Mr. Hunt himself, and a number of others, could prepare an article of a general character which would be a masterpiece; and I hope that the committee will not let this go forward as the final effort of the San Francisco engineers.

The Chairman: In that connection I would say that the general idea has been constantly present in my mind, both at the first meeting and at this; and it has been my intention to suggest to our committee on local meetings that, if we can arrange it within the finances allowed us from the parent society—if not I think we can probably get contributions to arrange it—to hold an intermediate meeting between this and our next three months' interval, so as to continue the matter; and if that is not sufficient we will still keep at it, because I think there is no subject which is of more vital interest to us here and on which we can contribute more value; and I shall be very glad to follow up the suggestion and do what I can to see it carried out.

Newly elected associate members of the American Institute of Electrical Engineers include W. R. Battey, designer for Southern California Edison Co., Los Angeles; A. L. Bradley, draughtsman Pacific Electric Engineering Co., Portland; L. P. Crim, engineer Pacific T. & T. Co., Seattle; E. W. Currier, electrical salesman Fairbanks, Morse & Co., Los Angeles; H. S. Curtiss, switchboard attendant Portland Railway, Light & Power Co., Portland; F. C. Ensinger, superintendent electric meter department San Francisco Gas & Electric Co., San Francisco; R. H. Fenkhausen, chief engineer Risdon Iron Works, San Francisco; G. G. Gunderson, manager electric department H. W. Johns-Manville Co., South Seattle; C. A. Harmony, city electrician Centralia, Wash.; V. H. Haybarker, electrician "Oregonian," Portland; C. M. Hoskinson, draughtsman Great Western Power Co., San Francisco; C. I. Kephart, student University of California, Berkeley; J. C. Love, Sacramento Electric, Gas & Railway Co., Sacramento, Cal.; J. A. Smith, switchboard operator, Washington Power Co., Reardon, Wash.; J. Z. Strauch, superintendent electric meter department, Sacramento Electric, Gas & Railway Co., Sacramento; O. E. Thomas, sales agent General Electric Co., Los Angeles; H. E. Truax, electrical machinist Bremerton, Wash.; A. N. Voss, foreman Goldfield Consolidated Mines Co., Goldfield, Nev.

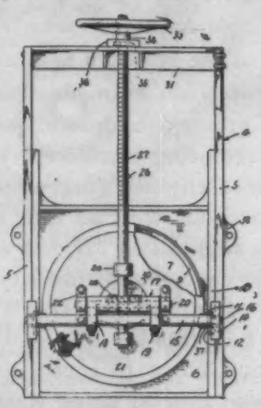
PATENTS

989,487. Lightning-Arrester. Elmer E. F. Creighton, Schenectady, N. Y., assignor to General Electric Company. The combination with three conductors of a transmission system, of four electrolytic condensers mounted side by side with corresponding terminals in electrical connection and



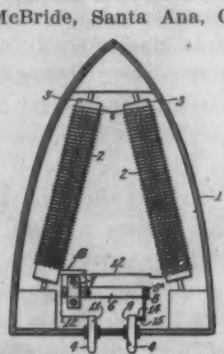
the other terminals of two of said condensers directly connected to two of said conductors, and a transfer switch connected to the third conductor and mounted to co-operate with the terminals of the two remaining condensers and thereby connect at will either of said remaining condensers to ground and the other condenser to said third conductor.

989,202. Head-Gate. Frank P. Snow, Los Angeles, Cal., assignor to Kellar-Thomason Manufacturing Company, Covina, Cal. In a device of the class described, a frame having a seat, a disk adapted to come against said seat, a stem car-



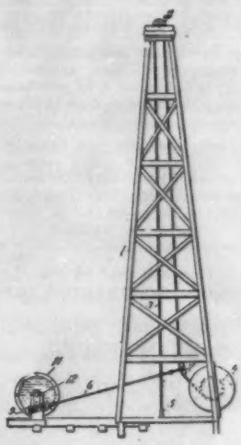
rying said disk and having a limited sliding movement on said disk, means for raising and lowering said stem to withdraw said disk from said seat, means for arresting the movement of said disk adjacent to said seat, and means for moving said disk upon said seat when arrested.

989,273. Thermostatic Control for Electric Heating Devices. Elmer C. McBride, Santa Ana, Cal. A thermostatic



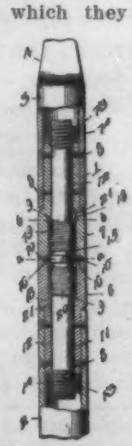
controlling means for electric heating devices comprising a fixed terminal means provided with a contact point, a thermostatic bar supported at one end and having at its other end an arm provided with a contact point for co-operation with said fixed contact point, means for connecting the said bar and terminal in the electric heating circuit, said bar being relatively rigid and said arm thereon having a slight elasticity in order to prolong the intervals of contact and of disruption of the circuit substantially as set forth, and means for adjustably supporting said thermostatic bar to adjust the relative position of the aforesaid contact points.

989,184. Well-Drilling Apparatus. Samuel S. O'Connor, Santa Monica, Cal. In a well drilling apparatus, in combination, a drill line having a drilling tool secured thereto, a rotatable crank arm, a block pivotally secured to the crank arm, a frame slidable on the block and having end pieces



located on opposite sides thereof, a spring bearing between one of the end pieces and the block, a headed rod passing through the other end piece, a jerk line secured at one end to the rod and connected at the other end with the drill line and a second spring bearing between the rod-head and the last mentioned piece.

989,112. Trolley-Pole. Charles E. Bradford, Lakeview, Wash. A trolley pole having tubular alining members disposed end to end, and provided in their meeting ends with segmental slots, in combination with a spindle connecting said members, and to which they are swivelly connected,



said spindle having radial stop studs operating in said slots of said tubular members, and reversely coiled springs on said spindle, and in said tubular members, one end of each spring being connected to said spindle and the other end being connected to one of said tubular members.

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POWER AND GAS

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FOUNDED 1887 AS THE
PACIFIC LUMBERMAN, CONTRACTOR AND ELECTRICIAN

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Modernized Hydraulic Construction

In the vast region from "the Rockies to the Coast," many hydroelectric and irrigation systems have been designed in accordance with unique rule-of-thumb methods, whose use dates back to the pioneer settlers who had few facilities in a new country of peculiar climatic conditions. The characteristically mild winters and long, dry summers allowed the construction of rock-fill dams, wood flumes and earth canals which have withstood the test of time, but which would have been impracticable in other less-favored sections. While they satisfied the rude needs of the hydraulic miner they are not so well adapted to hydroelectric and irrigation service and are gradually being supplanted by modern engineering methods.

Many engineers of high standing have come into the West for the first time with the avowed purpose of improving these crude efforts of the early hydraulic miners, whose judgment, as based upon hard experience with timber, rocks and floods, dictated this style of construction. Their failure has been as signal as would be that of the pioneer Western miner under equally strange conditions in the East. The difference between good and bad engineering rests in the success or failure of its result, and it is only by a full appreciation of those conditions which have developed the individuality of the Western mountain engineering, that these structures can be made stable.

Among the greatest hydraulic projects of today are those which are being carried out by the Reclamation Service, whose engineers have combined the old common-sense methods with all that modern thought and practice can suggest. Provided with every facility, they are now developing a new type of construction such as is exemplified in the Tieton canal described elsewhere in this issue, and which employs a reinforced concrete flume to meet the exacting conditions of the rapid flow of much water through long canals which must be at once permanent and cheap.

The box-flume is a relic of the days of cheap and abundant timber, when depreciation and replacement were as unconsidered trifles. Canals excavated in earth or rock may often be safely used in the mountains, but even these must ultimately be rebuilt in more permanent form. Choice is consequently narrowed to steel or concrete, either as pipe or lining. Concrete is less subject to deterioration, but its first cost is sometimes prohibitive. Where there is a permanent and sufficient ground backing, as is the case with the Los Angeles aqueduct, the end justifies the means, but to obtain a self-contained canal having a high factor of safety against slides, earthquakes, wet snow and even falling trees and at the same time keep within a unit cost which will not vitiate the earning power of the project, the plan which has been put into effect in the Tieton project seems admirable.

PACIFIC COAST MEETING OF NATIONAL ELECTRICAL SUPPLY JOBBERS' ASSOCIATION.

The first Pacific Coast meeting of the National Electrical Supply Jobbers' Association will be held at Del Monte, California, April 25, 26, 27, 1911. A 9-car train, leaving Chicago on April 18 is scheduled to arrive at the Hotel Del Monte on the evening of the 24th, with stops at the Grand Canyon and Los Angeles. The program for the meeting follows:

Tuesday, April 25th.

10 a. m.—Jobbers' first session.

10 a. m.—Ladies will visit Monterey, Old Mission, Presidio, Pacific Grove and points of interest.

1 p. m.—17-Mile-drive. Ladies, jobbers and manufacturers, as guests of the San Francisco manufacturers' representatives.

8 p. m.—Concert in ballroom.

8 p. m.—Jobbers' second session.

Wednesday, April 26th.

9 a. m.—Manufacturers' qualifying round at golf, 18-holes medal play. A trophy to be presented by Hotel Del Monte to player making lowest score. One-half dozen golf balls will be presented the player making nearest the average score.

10 a. m.—Ladies entertained by trip to Marine Gardens at Pacific Grove as guests of the Pacific Coast Jobbers.

10 a. m.—Jobbers' third session.

1 p. m.—Jobbers' qualifying round at golf, 18-holes medal play. A trophy will be presented by Hotel Del Monte to player making the lowest score. One-half dozen golf balls will be presented to player making score nearest the average.

2 p. m.—Trap Shooting. Trophy to be presented to the winner.

2 p. m.—Tennis Tournament. Open to manufacturers and jobbers. A trophy to be presented to the winner and runner-up.

2 p. m.—Ladies' Tennis Tournament. Suitable prize to be presented to the winner.

8 p. m.—Jobbers' fourth session.

9 p. m.—Dancing in the ballroom.

Thursday, April 27th.

9 a. m.—Manufacturers in final 18-hole medal handicap Golf Tournament, consisting of three flights—10 in first, 10 in second, balance of players in third. Trophy to be presented to the winner and runner-up of first flight. Trophy to be presented to the winner of second flight. Trophy to be presented to the winner of third flight.

9 a. m.—Jobbers' fifth session.

11 a. m.—Jobbers in final 18-hole medal handicap Golf Tournament, consisting of three flights, 10 in first, 10 in second, balance of players in third. Trophy to be presented to winner and runner-up of first flight. Trophy to be presented to the winner of second flight. Trophy to be presented to winner of third flight.

11:30 a. m.—Luncheon to the ladies at Pebble Beach Lodge, as guests of the Hotel Del Monte.

Note:—Automobiles will be at entrance to convey the ladies to the lodge. The automobiles are furnished with the compliments of the Pacific Coast Jobbers.

1 p. m.—Pool tournament. Open to manufacturers and jobbers. Trophy to be presented to winner and runner-up. This Pool Tournament is under the supervision of T. E. Burger.

7:30 p. m.—Spanish Dinner in Monterey for everybody. Many novel features.

PACIFIC COAST MEETING A. I. E. E.

The 1911 Pacific Coast Convention of the American Institute of Electrical Engineers is to be held in Los Angeles, Tuesday, April 25th, to Friday, April 28th. The sessions are held under the auspices of the Institute through the direction of the Telegraphy and Telephony, the High Tension Transmission, and the Railway Committees. Thus it is not a local meeting, but one in which the entire Institute membership has a part, and particularly those residing on the Pacific Coast. Headquarters will be in the Hotel Alexandria. The program for the meeting follows:

Tuesday, April 25.

Registration.

Auto trip through Los Angeles, Hollywood, San Fernando Valley and Pasadena for the ladies.

Section dinner for members and committees.

Wednesday, April 26.

Morning: Business.

Afternoon: Trip over Pacific Electric Railway, ending at Mt. Lowe, with dinner at Alpine Tavern. Ladies invited.

Thursday, April 27.

Trip via Salt Lake Railway (ladies included), to Redlands, Riverside and other points of interest. Luncheon at Santa Ana Canyon.

Dinner at Mission Inn, Riverside.

Business meeting in evening at Riverside.

Friday, April 28.

Business meeting.

Saturday, April 29.

Arrangements are being made for all who can stay over Saturday and Sunday to take an ocean trip to Santa Catalina Island. This is a most enjoyable trip and well worth waiting for. Return trip from the Island can be made Saturday night, if necessary.

The Southern Pacific Company will authorize reduced fare of one and one-third limited first class fare per capita on receipt-certificate plan from stations in California, including Reno, Nev., to Los Angeles, tickets to be on sale for going trip April 15th to 28th and certificates to be honored for return at one-third fare, providing there are 50 or more delegates in attendance holding properly issued receipt-certificates or round trip tickets, April 25th to May 1st to stations in California south of and including Santa Barbara and Bakersfield, and April 25th to May 8th to stations north of these points.

TRADE NOTES.

The Pittsburg-Silver Peak Gold Mining Company of Blair, Nev., has purchased from the General Electric Company one L.M.—103—A—1—4½-ton—24-inch gauge—250 volt, mining locomotive.

The Honolulu Rapid Transit & Land Co. of Honolulu has purchased from the General Electric Company ten straight-air brake equipments, for double-end operation, complete with "C. P. 27" air compressors.

Fowler & Mallett, agents for the Enos Company of New York, recently opened a large store at 353 Sutter street, San Francisco, where they have added a retail department. A large stock of high-class electric fixtures is now being shown.

S. H. Frank & Co. of Redwood City have purchased from the General Electric Company one C. C. 2, 35 kw., 3600 r.p.m., 250 v. no load, 250 v. full load, compound-wound Curtis turbine generating set arranged for 125 pounds steam pressure, together with switchboard. It will be used to drive electric motor for grinding tan bark.

PERSONALS.

Geo. Morton, of the Dow Pump Company, is at Los Angeles.

F. M. Blackburn, formerly of Salt Lake City, is now in charge of the municipal power plant at Eugene, Ore.

Hugh T. Duff, president of the Woodill-Hulse Electric Company, of Los Angeles, was a recent San Francisco visitor.

W. G. Hutchinson, an electric fixture manufacturer of Los Angeles, was a recent San Francisco visitor.

K. G. Dunn, electrical engineer with Hunt, Mirk & Co., returned to the San Francisco office this week after a trip to Portland.

E. P. Morphy, secretary of the Home Telephone & Telegraph Company, of Los Angeles, was a recent San Francisco visitor.

A. J. Wallace, president of the Sinaloa Land & Water Company, recently arrived at San Francisco from Los Angeles.

L. M. Peart, general superintendent of the San Joaquin Light & Power Corporation, recently spent a few days at San Francisco.

H. F. Eicher has arrived on the Pacific Coast from the factory of the Fort Wayne Electric Works and will locate at the Seattle office.

J. W. White, of the sales department of the Fort Wayne Electric Works, has returned to the San Francisco office after a Southern California tour.

O. B. Coldwell, general superintendent of the light and power department of the Portland Railway, Light & Power Company, is making a trip East.

George R. Field, assistant general manager of the Great Western Power Company, recently visited the hydroelectric transmission plant at Big Bend.

W. G. B. Euler, power house superintendent at the Great Western Power Company's Big Bend plant, recently visited the company's San Francisco office.

Samuel F. Keith, is now chief engineer of the power plant in the Humboldt Bank Building, succeeding Chief Engineer Lindsay, who resigned to go into the contracting business.

W. F. Lamme, formerly with the Westinghouse Electric & Mfg. Co., and Charles T. Phillips, have opened offices as consulting electrical engineers in the Pacific Building, San Francisco.

A. S. Crane, hydraulic engineer of J. G. White & Co., of New York, who recently arrived on the Pacific Coast, has gone to the Crane Valley and Southern California on an inspection tour.

C. E. Hardy, formerly electrical engineer with the Mare Island Navy Yard, is now connected with the San Francisco office of the Westinghous Electric & Manufacturing Company as industrial and application engineer.

S. G. McMeen, having resigned as vice-president and general manager of the Bay Cities Home Telephone Company, to devote more time to the engineering work of McMeen & Miller, is returning to Chicago by way of Del Monte and Los Angeles.

H. H. Noble, president of the Northern California Power Company, returned last week from a tour covering the Noble Electric Steel Company's plant at Heroult, Cal., as well as the hydroelectric system. He says that the Coleman plant will be completed and transmitting current within the next three months.

L. A. Somers, of the sales department of the Westinghouse Electric & Manufacturing Company, returned to the company's San Francisco office during the past week from the factory at East Pittsburg.

F. M. Smith, president of the United Properties Company, controlling the Oakland Traction and the Key Route system, of Oakland, returned last Wednesday from a trip to New York, in connection with completing the organization of the new holding corporation.

H. A. Lardner, manager of J. G. White & Co.'s Pacific Coast offices, spent the past week at Los Angeles and other points in Southern California. He inspected some of the work which his company is doing for the San Joaquin Light & Power Corporation. Good progress is being made on the extension of the Crane Valley development and two additional General Electric generators of 4000 k.v.a. capacity have been shipped to the plant. At the Bakersfield steam plant a 2500 k.v.a. generator has been started up and a 6250 k.v.a. unit is being installed.

NEW CATALOGUES.

Bulletin No. 1624 from the Allis-Chalmers Company illustrates and describes their standard single storage centrifugal pumps.

The Sprague Electric Company have issued a handsome catalogue of Sprague Electric Fans for 1911 for both direct and alternating current circuits.

Bulletin No. 130, recently issued by the Crocker-Wheeler Company, contains information on their small direct current generating sets, 1.75 to 21 kw.

Bulletin No. 4817, issued by the General Electric Company, describes that company's 75 h.p. direct current commutating pole railway motor which represents the latest construction in this class of apparatus.

The Chamber of Commerce of San Francisco have issued the first number of their "Journal," an interesting and creditable publication summarizing trade conditions on the Pacific Coast and in all the great commercial, financial and trade centers of the world.

Bulletin No. 1079 from the Allis-Chalmers Company is concerned with steam turbines and generators, the turbine being a modified Parsons type, which is lucidly described by text and drawing. The catalogue is further illustrated by a large number of half-tone engravings of typical installation of Allis-Chalmers high pressure condensing, high pressure non-condensing and low pressure condensing turbo-generator installations.

Geo. E. Dow Pumping Engine Company of San Francisco have issued a handsomely printed catalogue on Agricultural Pumps. Aside from the excellence of the typographic make-up it contains much valuable data on the choice of pump types for various work, instructions for installing centrifugal pumps, information on ditch construction and a tabulated statement of the amount and pressure of air necessary to raise water. The arrangement is such that a page of data alternates with a page of description.

Bulletin No. 1003, describing magneto convertible non-multiple switchboards with self restored line signals, has just been issued by the Western Electric Company. The switchboards described are so designed that they can be used originally for magneto service and can be converted at will to central battery operation. They are recommended for exchanges where the ultimate number of lines will not exceed 500. The bulletin is illustrated with wiring diagrams of circuits and with many views of the apparatus used in convertible switchboards.

INDUSTRIAL

A NEW METHOD OF MOTOR CONTROL.

The acceleration of electric motors has in the past been accomplished by different starting devices varying from a simple hand operated type to the magnetic switch motor starter. A magnetic switch starter, by the proper operation of magnetically operated switches, cuts out, step by step, the starting resistance. Such operation is automatic and in a properly designed apparatus affords thorough protection to the motor and to driven machinery. A magnetic switch motor starter is expensive and complicated but despite these handicaps it has been widely used in connection with large motors and for automatic control, because of its obvious advantages. Without attempting to enter into a discussion of existing motor starters, it can be stated, wihout fear of contradiction, that the highly desirable automatic and protective features are secured only at the expense of relatively high cost and complication involving a multiplicity of parts, sensitive relays, and coils wound with wire as fine as thread.

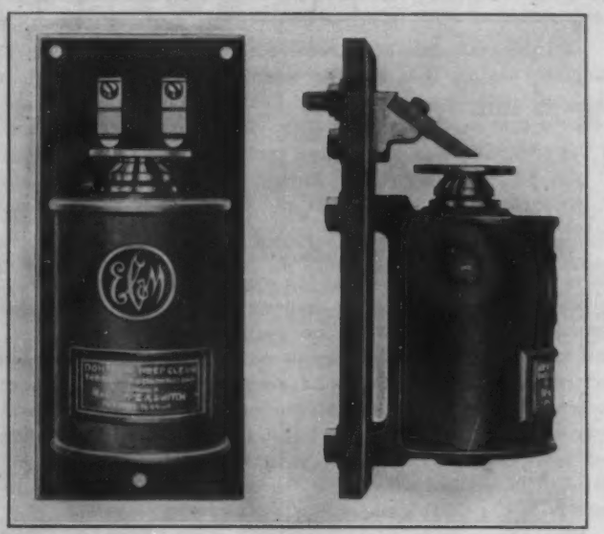


Fig. 1.

The Electric Controller & Mfg. Co. of Cleveland, Ohio, has discovered and developed commercially a magnetic switch radically new in principle and operation. This switch has an operating coil which is connected in series with the motor to be started, this coil being composed of a few turns of heavy wire of fire-proof insulation. The switch has the remarkable characteristic of inherently and automatically closing its contracts only when the motor current is below a predetermined value. It is in other words a combined magnetic switch and current limiting relay. If the motor current flowing through this switch exceeds a predetermined value this switch will lock out and will not close until the current has been reduced by the speeding up of the motor. A train of these switches cutting out the starting resistance step by step provides a method of motor acceleration which is absolutely automatic and protective, and it accomplishes this with apparatus so simple that its expense will not prohibit its application for the starting of any electric motor.

The front and side views of such a magnetic switch are shown in Fig. 1. The operating coil is enclosed and protected by a cylindrical iron shell mounted on a slate panel; at the top are two copper laminated brushes which, when the switch operates, are short circuited, thereby cutting out a section of resistance. At the bottom of the coil shell a movable plug is provided for adjusting the amount to which current must fall before the switch operates; screwing in this plug will increase the lock out value, and, of course, screwing out the plug will reduce the value of the lock out current.

Fig. 2 exhibits the operating characteristics of the switch. Here vertical distances represent current flowing through the operating coil; horizontal distances, positions of the adjusting plug. The shaded area indicates the operating limits of

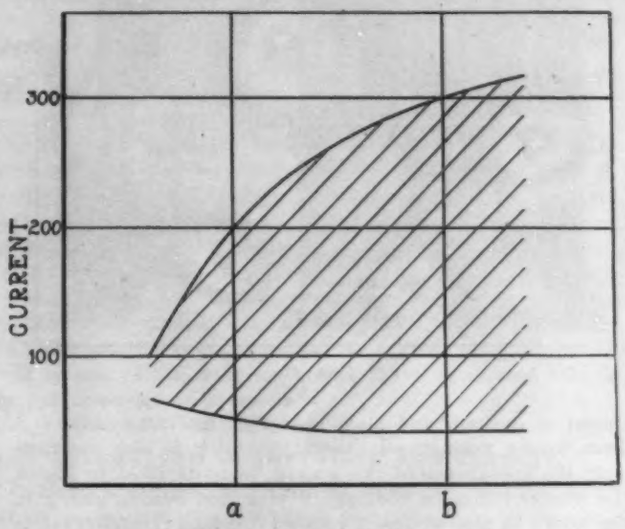


Fig. 2

the switch. For example, if the plug be at position "a," the switch will lock out at any current above 200 amperes but will definitely close as soon as the current falls to 200 amperes. Similarly, with the plug at position "b," the switch will lock out at any current value above 300 amperes, but will operate when the current falls to 300 amperes. The bottom of the shaded area indicates the minimum current at which the switch is operative although, of course, after the switch has once closed it will remain closed until the current has dropped to practically zero.

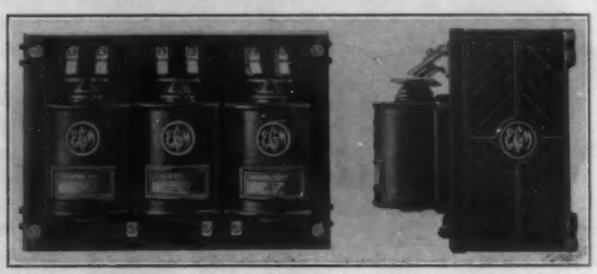


Fig. 3.

It will be apparent from what has been said descriptive of this switch (termed the type A switch) that its use is peculiarly suitable for motor starters. As a matter of fact the Electric Controller & Mfg. Co. has developed a complete line of motor starters embodying the use of the type A switch, these starters having been designated Type E. C. & M. automatic motor starters. They have been standardized for 110, 220 and 550 volts direct current current and over a wide range of horse powers. In order to make them as universally applicable as possible, the starters have been laid out in six different forms and, in addition, with various numbers

of the accelerating switches. The simplest form consists merely of a train of type A switches suitably mounted in connection with resistance, and the front and side views of such a starter are illustrated in Fig. 3. This starter is intended to be used in connection with a knife switch exterior to the starter. If it is desired to incorporate the knife switch in the starting panel this requirement can be met by the form illustrated in Fig. 4. Where push button or automatic

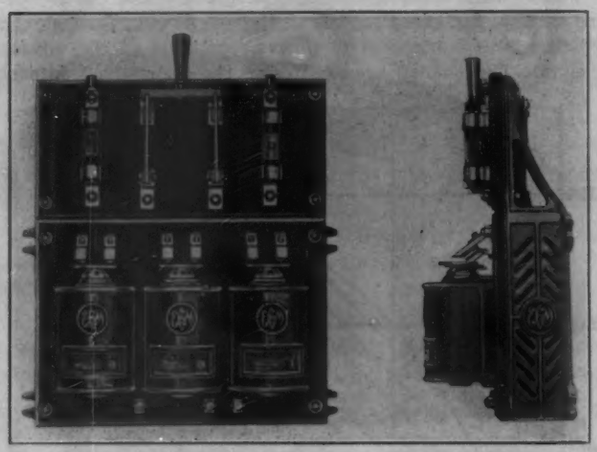


Fig. 4.

control is desired, and also preferably for large motors, a shunt wound magnetically operated switch is also incorporated; the appearance of this switch being depicted in Fig. 5. The starter including the type S magnetic switch, shown in Fig. 5, can be also equipped with an overload giving complete circuit breaker features and either of these modifications can be furnished with or without knife switches.

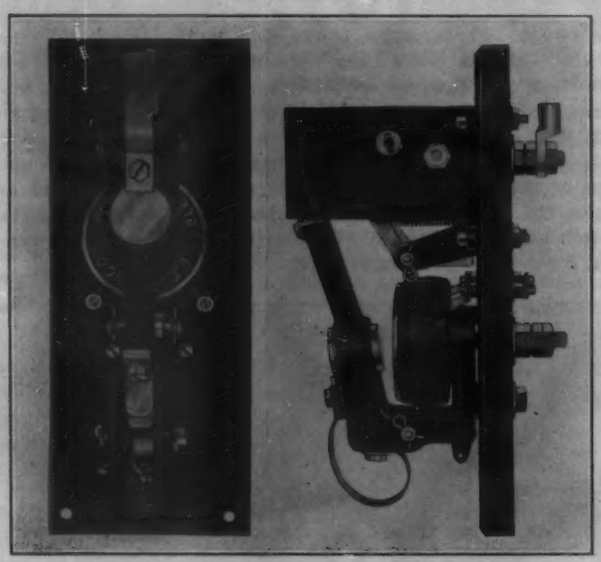


Fig. 5.

A complete line of accessories has also been developed, such, for instance, as would be required for automatic pressure regulation, maintenance of water level in water tanks, etc. The number of accelerating points which any particular starter will develop is one more than the number of accelerating switches used. For small motors where the load to be accelerated is light, one or two type A switches will be ample. On the other hand, for large motors, and particularly motors which have to accelerate heavy inertia loads, five or six type A switches should be selected.

Even the simplest form of the E. C. & M. automatic motor starter inherently provides no-voltage protection, for if the voltage fails, all of the switches at once drop out, inserting all of the starting resistance in series with the motor, and upon the return of voltage the motor is automatically accelerated in the normal method. With such a starter it is merely necessary to close the knife switch to start the motor and to open the knife switch to stop the motor. The acceleration of the motor is entirely automatic and will be accomplished in the shortest, safe time. If the load be light, the switches will close rapidly and bring the motor up to full speed in a short period of time. On the other hand, if the load to be accelerated be large, as for instance, if it be a punch press having a large fly wheel, the switches will close much more slowly and the time required to bring the motor to full speed will be considerably lengthened. In any event, however, the motor is accelerated to full speed in the shortest safe time.

This type of switch also finds a large application in controller work and the Electric Controller & Mfg. Co. is prepared to furnish it in connection with either reversing or non-reversing controllers for motors of practically any h.p. and of the common voltages.

CHINA'S FIRST REAL TELEPHONE SYSTEM NOW GIVING SERVICE.

A cablegram has been received by the Western Electric Company stating that the two telephone exchanges which it has been installing in the city of Peking, China, were successfully cut into service on April 2nd. These exchanges are both of the common battery type and each equipped for 6400 lines. At present 3000 subscribers' lines are connected to this telephone system, which is owned and operated by the Imperial Government.

There have been no adequate telephone facilities in China. The need for a telephone system became so apparent several years ago that an imperial commission was sent abroad to study the telephone systems of other countries. The commissioners were impressed with the facilities and service in New York City and recommended an equipment along similar lines for the Chinese capital. The contract was awarded to the Western Electric Company, after its system had been carefully compared with those of its competitors both in Europe and America. The cost of the original equipment is in the neighborhood of $150,000.

The new telephone system covers the whole of both the Tartar and Chinese cities. Underground cable, 3½ inches in diameter and containing 400 paper insulated wires, has been used. The telephone system will employ about thirty operators, all of whom will be Chinese girls. The foreign residents in Peking are particularly pleased with the arrangement of one section of each switchboard for their use. English-speaking operators will be employed on these sections.

THE LARGEST STORAGE BATTERY IN THE WORLD.

A contract has just been made by the Consolidated Gas, Electric Light & Power Co. of Baltimore, Md., with The Electric Storage Battery Co. of Philadelphia, Pa., for the installation of an enormous battery to be used for emergency service. This battery will consist of 152 cells of the "Exide" type, each cell containing 133 plates. Each of the 152 lead lined wood tanks will measure 4 ft. 2 in. in height, 21¾ in. wide and 6 ft. 6⅞ in. long, and will weigh without plates or electrolyte 940 lbs. The total weight of the entire battery equipped with plates and electrolyte, when ready for service will be approximately 1,079,200 lbs. When fully charged it will supply sufficient electric current to light 120,000 twenty-five watt tungsten lamps for one hour or 240,000 such lamps for twenty minutes, having an output of 4000 h.p.

These huge emergency or "stand-by" storage batteries are used by the large electric lighting companies to provide

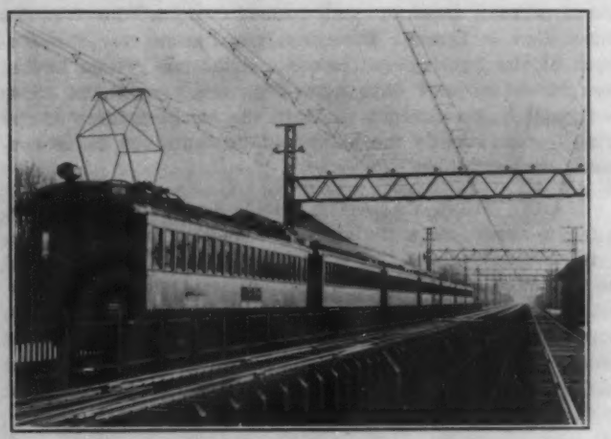
for unusual demands for current, caused sometimes by a temporary accident to electric generating machinery, or by sudden darkness preceding a thunderstorm, or as recently experienced in New York City by a heavy snow fall which within ten minutes increased the demand for current on the New York Edison Company's system from 100,000 to 166,000 h.p. In this case the rate of increase in current was so rapid that it was impossible to connect additional engines with sufficient rapidity, and the storage batteries were called upon to meet the emergency, thus saving New York City from darkness.

These batteries are popularly called "the watch dogs of the system" as they are instantly ready to supply enormous quantities of electricity, thus insuring electric light and power at all times and at the same time protecting electrical apparatus from sudden strains caused by large demands for current.

The Electric Storage Battery Company has installed 44 batteries for the New York Edison Company, many of which are almost as large as the one now being built for the Consolidated Gas, Electric Lighting & Power Company of Baltimore. Similar batteries have been supplied to the electric lighting companies in Chicago, Minneapolis, Brooklyn, Boston and Spokane, and many other large electric lighting companies, appreciating the protection from such batteries, are now considering an installation.

THE NEW YORK, NEW HAVEN & HARTFORD LEADS IN PUNCTUALITY.

One of the advantages claimed by advocates of electrification of main line roads is reliability of operation. It has been unofficially stated several times recently that the New York, New Haven & Hartford had practically no motive power delays in handling the entire passenger traffic of its New York end by Westinghouse electric locomotives and multiple unit trains, notwithstanding the change over from steam to electricity at Stanford.



N. Y., N. H. and H. Electric Train.

From reports of train operations in New York State during January, recently given out by the Public Service Commission, it appears that the New York, New Haven & Hartford made the best showing of any road in the State with 90 per cent of its trains on time.

The report is especially interesting in view of the fact that the New Haven is extending its single phase electrification to its Harlem division and another branch, and reported as planning extension to New Haven.

Of the roads entering New York City it is interesting to note that three of the electrically equipped roads, namely, the New Haven, Long Island and Pennsylvania stand high with 90, 86 and 84 per cent respectively.

A NEW LARGE HYDROELECTRIC PLANT FOR THE STATE OF OAXACA.

The Cia. Minera de Natividad y Anexas, one of the most active mining properties in the State of Oaxaca, located in the Sierra Juarez District, have recently purchased from the Cia. Ingeniera, Importadora y Contratista, S. A., successors of G. & O. Braniff & Co., a new hydroelectric plant of 1000 h.p. capacity. The installation of this plant has been found necessary on account of the increasing output of the mine and for the proper milling and cyaniding of the ore to be handled.

The mining company already has a power plant which was installed many years ago but which was insufficient to meet the present demand and the company is now building a canal which will take the waters from the tail race of the old plant, and by using an available head of about 170 meters, can develop the 1000 h.p.

This new plant will comprise two 500 h.p. Pelton water wheels, which will be direct coupled to two 375 k.v.a. Westinghouse alternating current generators. The power house will also be equipped with two 15 k.w. exciters, each of sufficient capacity to excite both generators; also a large switchboard for control of the machines and out-going circuits. The transmission line will be about two miles long at 2400 volts, three-phase, and the power will be for motors in and about the mine and mill. This plant when completed will be one of the most modern in the country, and will be in full operation in a few months.

CELEBRATED TWENTY-FIFTH ANNIVERSARY.

Hugo Reisinger celebrated on April 1st the twenty-fifth anniversary of the establishment of his business as importer of carbons and other electrical supplies. The employes of the firm presented Mr. Reisinger with an artistic address bound in leather and silver with the signatures of the entire staff attached. Mr. Reisinger was the pioneer in the importation of lighting carbons to this country, and was the first to cause to be manufactured at the works of C. Conradty, Nuernberg, enclosed arc and flaming arc carbons. He is probably more thoroughly identified with the carbon and lamp business than any other dealer in America, and the trade mark "Electra" of his carbons is known to every one in the electrical field. Mr. Reisinger took a prominent part two years ago in the fight for a lower tariff on lighting carbons, and it was largely through his personal effort that the rate of $1.00 per hundred feet at first proposed in the new tariff bill was reduced to 65 cents. Mr. Reisinger suggested that 20 cents per hundred feet would be about fair, but it was impossible to push this reduction through. Outside of business Mr. Reisinger has devoted a great deal of time to art matters, and has promoted the exchange of works of art between America and Germany. He was honorary commissioner general for Europe to the World's Fair at St. Louis in 1904, has twice been decorated by the German Emperor and once by the Prince Regent of Bavaria. He is an active member of the New York Chamber of Commerce, and a director in many important companies.

E. C. Hutchinson of the Pelton Water Wheel Co. recently returned from a trip to Mexico taken in connection with the remodeling of a hydroelectric plant belonging to the Compania de Transmission Electrica de Cotoencia, which supplies electric current for the mines near Pachuca. The water wheels of the eleven generating sets, six of which were constructed by German engineers, will be replaced by Pelton wheels having an aggregate capacity of about 4000 kw. The main office of the electric company is in the City of Mexico.

NEWS NOTES

FINANCIAL.

BUTTE, MONT.—The Butte Electric Supply Company of Utah, capital $250,000, has been incorporated by E. E. Brazier et al. This city will be the principal place of business.

DRAIN, ORE.—At the regular city election held at Drain the citizens voted bonds in the sum of $20,000. Of this amount $15,000 will be spent in installing a water system, while the remaining $5000 will be expended in laying sewers.

FALLS CITY, ORE.—Bids for the construction of the city water system have been received by the council as follows: Moffett Parker, Oregon City, $24,299.20; K. Lancher, Corvallis, $24,200; H. Benske, Portland, $23,524.20; The John Contracting Company, $21,206.

PALO ALTO, CAL.—Palo Alto has voted strongly in favor of the issue of $50,500 worth of municipal bonds to extend the policy of city ownership. Only two out of the seven separate issues voted on were defeated, one of these being a proposition to expend $20,000 in building a spur track to the municipal lighting plant and the other being an item of $2500 for a city jail. The measures favored were: An auxiliary pumping plant, $2000; a steam conductor and water cooler at the municipal water-works; a concrete building for the municipal lighting plant, $20,000; a garbage incinerator, $15,000, and an automobile fire engine, $6000.

ILLUMINATION.

UKIAH, CAL.—The Supervisors have passed an ordinance granting the Ukiah Gas Company a franchise to construct its lines, etc., in Ukiah.

YUBA CITY, CAL.—It is proposed to form a new lighting district to comprise most of the town of Live Oak, and an election has been called for April 24.

PORT TOWNSEND, WASH.—The Western Steel Corporation has made application to the Board of Commissioners for a franchise for the use of certain streets in Irondale for lighting purposes.

RED BLUFF, CAL.—Superintendent Charles Hughes of the Northern California Power Company, announces that the company will immediately begin the extension and improvement in its gas system in this city.

MADERA, CAL.—A canvass is being made of the town with a view to the installation of a gas plant here, and if 400 citizens will sign up to use the gas either for lighting or heating purposes, a plant will be installed.

DORRIS, CAL.—A special meeting of the Town Board of Trustees will be called in a few days to consider a franchise, applied for by the Siskiyou Light & Power Company of Yreka, to furnish Dorris with electric power.

STOCKTON, CAL.—The West Coast Electric Battery Company, manufacturers of individual low voltage storage battery electric light and power plants, has opened Stockton offices in charge of F. P. Davis as general manager.

CHICO, CAL.—Chico will soon have a conduit system in the business section of the city for the power, light, telephone and telegraph wires. The Pacific Gas & Electric Company and the Sacramento Valley Power Company are waiting the arrival of material for the conduit system. Work will begin during April or early in May.

CLAREMONT, CAL.—The City Council has passed an ordinance granting to the Pacific Light & Power Corporation a 50-year franchise to erect poles and string wires for electrical purposes along Mills avenue from N. First to north of the city limits.

LAKEPORT, CAL.—J. A. Foster and J. L. Davis, have made application to the Board of Trustees for the granting of a franchise to erect and maintain poles upon the public streets, roads, highways, avenues, bridges and alleys, in the town of Lakeport.

CHEHALIS, WASH.—The Council has passed an ordinance granting to the Twin City Light & Traction Company a new light and power franchise. They will begin work at once on their new power house, the cost of which is estimated at $75,000, to be located on Coal Creek.

BERKELEY, CAL.—The attempt of the Council to permit the people to fix their own water and electric rates met a setback this week, when, following the action of the People's Water Company in serving a writ of mandate on City Clerk Walter Sanborn to prevent him from placing an initiative ordinance on the city ballot at the election April 22, the Oakland Gas, Light & Heat Company took similar action.

QUINCY, CAL.—Harold R. Ebright of San Francisco has deeded to the Oro Water, Light & Power Company water rights aggregating 60,000 inches of the water of four creeks flowing into the north fork of the Feather River. The water in the reservoir will be carried in ditches and pipes from the reservoir to a point where a plant will be constructed on the bank of the Feather River near the mouth of Yellow Creek.

EUREKA, CAL.—The holdings of the Arcata Lighting Company have been officially taken over by the Western States Gas & Electric Company, negotiations for the purchase of the lighting and power distributing system having been closed several days ago. For the present, at least, there will be no changes made in the working force of the Arcata system while the plant will be continued to be conducted as heretofore.

MARYSVILLE, CAL.—The Pacific Gas & Electric Company has announced a sliding scale reduction in lighting rates in the business district of Marysville. To get the benefit of the reduction the Marysville merchant must install a meter, and use more than $7.50 worth of current in a month. On monthly bills ranging from $7.50 to $150 the rate becomes smaller as the amount of current consumed increases, the maximum being 8c per kw. hour and the minimum 3c per kw. hour.

SACRAMENTO, CAL.—A new light and power company, to be known as the Citizens' Light & Power Company, is to be established in Sacramento, financial backing to be furnished by local capitalists, including George W. Peltier and the Fleishhacker interests of San Francisco. The new concern will have an authorized capital of $2,500,000 and may issue bonds for a like amount. The plant will be put in operation this fall, and will start with the distribution of the power from the Great Western Company. A steam plant will be erected as a secondary electric supply for the winter months to insure continuous service.

PORTLAND, ORE.—A resolution has been passed by the City Council of Portland to extend for one year, or until July 1, 1912, the time in which the Portland Railway, Light

& Power Company is required to equip all of its cars with automatic fenders in accordance with the provisions of the ordinance passed by the Council in the fall of 1910.

PHOENIX, ARIZ.—The Phoenix Railway is now building a new substation in Phoenix. The machinery to be installed will consist of a 100 kw. motor generator set with transformers, oil switches, switchboards and necessary auxiliary apparatus.

BISHOP, CAL.—The Owens River Valley Electric Railway Company advises it will build a 4½-mile electric railway to connect Bishop and Laws, and extending to Round Valley, a distance of 12 miles. The company will purchase power. Harry Shaw of Bishop is president, Curtis Hillyer, San Francisco, secretary and treasurer, and Raymond Spaulding, Bishop, chief engineer.

OAKLAND, CAL.—Plans for a half million dollar improvement of the electric lighting system of the Oakland Gas, Light & Heat Company, have been practically completed. Because of the rapid growth of the city and the increased demand, the power plant of the corporation is said to be getting more and more inadequate to meet the needs of the company. Recently a contract was signed by officers of the company for the installation of a 20,000 h.p. of 16,000 kilowatts electric turbo-generator. The installation of this generator will require the use of 10,000 extra boiler power. This will practically double the present capacity of the electric plant of the company. Frank A. Leach Jr., president of the Oakland Gas, Light & Heat Company, says that the additional machinery will probably be operating by November. The turbo-generator will cost approximately $500,000 when installed.

MARYSVILLE, CAL.—Paul Downing, the engineer of electrical construction of the Pacific Gas & Electric Company, who has been making a tour of inspection of the company's several large electric plants and its main transmission lines, states that the present flume and ditch system carrying water for eight miles around the sides of a mountain to reach the Colgate plant east of here is to be abandoned. Instead a big tunnel will be pushed through the mountain. It will be an expensive undertaking in building, but inexpensive in operation and repair. Just when the work will be commenced is not yet decided. Another improvement to be made is the substantial steel towers for the present poles on the main transmission lines from Colgate to San Francisco bay. This also will be an expensive work, but will soon pay for itself in reducing operating and repair expenses, and in continuity of service. All the main distributing lines will eventually be carried on these towers.

LOS ANGELES, CAL.—The Southern California Gas Company will not be granted a blanket franchise for Los Angeles County by the Board of Supervisors. E. O. Edgerton, secretary of the Municipal League has lodged a vigorous protest against it. The Board will deny the application of the corporation without prejudice. This will then permit the gas company to obtain a franchise covering certain specified sections of Los Angeles County. The company has applied for a 50-year blanket franchise. The board held the matter up some time ago and desired to reduce the period to 40 years. A protest was made by representatives of the company. One of the reasons why the Board of Supervisors will refuse to grant the blanket franchise is that to do so will will mean the elimination of all competition in the county. Supervisor Butler stated that if the Board did so the smaller gas corporation would not enter into new fields, because the larger and more powerful corporation would immediately get into competition with it. The damage to county roads built under the good roads project is also an argument against granting the franchise, according to Mr. Butler.

time will be consumed in the run to Woodbridge. Lodi will be greatly benefited by the addition of the new road.

OREGON CITY, ORE.—Officials of the Canby Canal Company are interested in the plan to construct an electric railway from Canby to Molalla, with feeders extending to Beaver Creek, Meadowbrook, Colton, Needy and Macksburg. There is a possibility that the road will cross the Willamette River and connect with the Oregon Electric near Wilsonville.

PHOENIX, ARIZ.—Superintendent S. H. Mitchell is progressing rapidly with the improvement of the Phoenix street railways. Poles and wire are upon the Glendale line as far as Central avenue and will be completed to the end of the line in Glendale within 10 days. Two other lines, which are likely to be commenced soon are the Ingleside and the Scottsdale, and an important south side line on Central avenue, across the new bridge and through Tempe to Mesa.

MONTEREY, CAL.—The broad gauging and reconstruction of the track of the Monterey & Pacific Grove Electric Railway has begun. One block will be done at a time, in order to keep the cars running it will be necessary to lay a temporary third rail. The ties are to be set in concrete. A couple of the best cars will be rebuilt, and other rolling stock will be purchased in the East. As soon as the road can be broad gauged the equipment will be modern and up-to-date in all particulars.

TRANSMISSION.

GRANGEVILLE, IDAHO.—The Grangeville Electric Light & Power Company is preparing to extend its lines from Cottonwood to Vollmer and Ilo, work to start at once.

CENTRALIA, WASH.—A bond in the sum of $10,000 was deposited by the Twin City Light & Traction Company, guaranteeing the erection of a new power plant on Coal Creek.

CULVER, ORE.—The Cove Power Company has begun construction of a power plant on the Crooked River, two miles west of Culver. Brown & Van Valkenburg have contracts for a large part of the work.

CASTLEROCK, WASH.—Collins & Everly are engaged in developing a power project on Toutle River, eight miles from here on the Tower road. They expect to generate 1000 h.p. and will take six months to complete.

JACKSON, CAL.—Leopold D. Caminetti has located 20,000 inches of water from the Mokelumne River five miles west of this city. The water is to be used to furnish power to generate electricity. The location is in Rocky Canyon.

REDDING, CAL.—The Northern California Power Company has started work on its new power line from Hamilton to Princeton. This line connects with the 60,000 voltage transmission line, which has already been carried into Hamilton and it will be extended to Arbuckle as rapidly as possible.

WALLA WALLA, WASH.—The Pacific Power & Light Company announces that it will start the construction of a transmission line from Walla Walla to Dayton by way of Dixie, Prescott and Waitsburg. The line will cost $50,000.

SONORA, CAL.—The Tuolumne River Power Company, a Maine and California corporation, has transferred its holdings in Tuolumne County, to the Yosemite Power Company. The Tuolumne River Power Company, which has been sold, included a large tract of timber land, 65 miles of water ditch, water rights, power sites and irrigation rights on the Tuolumne River, and it was sold for approximately $650,000.

TRANSPORTATION.

OAKLAND, CAL.—The Oakland, Antioch & Eastern Railroad has made application for a franchise in Shafter avenue, from Rock Ridge to Fortieth street.

PASADENA, CAL.—The Pacific Electric Railway Company has announced that beginning at once the California street line will be double-tracked for its entire length.

TURLOCK, CAL.—S. N. Griffith has made application to the Board of Trustees for a 50-year franchise to construct and operate a single track street railway in the city of Turlock.

TWIN FALLS, IDAHO.—Negotiations have been entered into by W. L. Cherry and associates for the purchase of ties and rails for the construction of an interurban railway from this place to the Snake river canyon, to be built this summer.

BELLINGHAM, WASH.—Leslie R. Coffin of the Whatcom County Railway & Light Company has submitted plans and designs to the Stone & Webster officials for the new electric interurban cars to be used on the Bellingham-Skagit interurban.

ELLENSBURG, WASH.—Paul L. Richards has applied to the County Commissioners for the right to construct and operate an electric motor line railway system in Kittitas County. May 1, at 1 p. m. has been set as time when the board will hear the application.

LODI, CAL.—The California Traction Company will commence work immediately upon the extension of its road from Lodi to Woodbridge. The plan is to have the road in working order in time to handle this year's grape crop. As soon as the line is completed the passenger service to Woodbridge will be in order. At present the cars running between here and Stockton are obliged to remain here 15 minutes, which

TELEPHONE AND TELEGRAPH.

UKIAH, CAL.—J. A. Cuminsky has applied for a telephone franchise in this city.

PALOUSE, WASH.—The Interstate Telephone Company announces that a telephone system to cost $20,000 will be installed in this district.

DAYTON, WASH.—The County Commissioners have granted a franchise to the Mount Vernon Telephone Company to construct and operate a rural telephone line from this place to a point near the Wenaha forest reserve.

VICTORIA, WASH.—The British Columbia Telephone Company will soon increase its telephone service here by ordering about 900 additional telephones. An underground distributing system will be installed and other improvements made.

NAPA, CAL.—Supervisor W. Casey and other taxpayers of Browns Valley precinct have filed with the Board a petition for permission to construct a telephone line, beginning at a point on First street and running westerly along the south line of the county road one mile.

SUSANVILLE, CAL.—The Johnstonville Telephone Company has applied for a franchise to erect, construct and maintain poles and wires along streets, alleys, avenues, and highways, for a general telephone business in this town. Sealed bids will be received up to 8 p. m., May 29th, 1911, for the sale of the franchise, to R. E. Bangham, Clerk.

PASADENA, CAL.—President A. B. Cass of the Home Telephone Company announced that his company will erect a $30,000 power plant on the east bank of Arroyo Seco, and will install telephones for about 300 residents. South Pasadena will then be the center of distribution for Pasadena, San Gabriel, Alhambra, Eagle Rock and part of Garvanzia.

WATERWORKS.

LEMOORE, CAL.—Marshal Dickenson has been ordered to have new mains laid along Bush street and Lemoore avenue.

SILVERTON, ORE.—The Mars Construction Company of Seattle has been awarded the contract for the construction of water and sewer systems for Silverton.

MARSHFIELD, ORE.—Plans for a joint water system for North Bend and Marshfield with estimates of probable cost, are being prepared by J. L. Stannard of Stannard & Richardson, of Portland.

SNOHOMISH, WASH.—The City Council has let a contract for the building of 16 miles of gravity water mains to supply the city with water, to the Atlas Construction Company of Everett, whose bid was $83,250.

MANTECA, ORE.—A contract has been signed between the Manteca Improvement Company and A. Bacilieri which provides for a complete water-works system for domestic and fire protection to be installed at once.

FRESHWATER, ORE.—Mr. G. Jaeger of Rich Hill, Mo., who has also an office in Chicago and Kansas City, arrived here last week and made preparations to start work on the water-works, the contract for which was let last December.

SUISUN, CAL.—At the meeting of the Board of Trustees of Fairfield last week the new water rate was passed. It allows the Fairfield Water Company to place meters where desired, the cost of the meter to be borne by the consumer.

SPOKANE, WASH.—R. A. Hutchinson, Elmer E. Hall and William S. Lewis, of Spokane, Wash., have filed a petition asking for a franchise from Spokane county for a period of 25 years, to lay water mains and operate a water system in and along the streets of Woodlawn Park Addition, Spark's Addition, Central Park Addition, and upon Sprague, First, Second, Third, Fourth, Fifth, Sixth, Seventh, Hartson, Eighth, Ninth, Tenth, Eleventh and Twelfth avenues.

SAN FRANCISCO, CAL.—The water rates committee of the Supervisors has requested the city water inspector to furnish a list of all localities in the city in which the Spring Valley Company has refused to lay water mains, or where its mains are inadequate to supply the residents of the district. This step is taken with the intention of bringing a suit to test the powers of the municipality to force the water-company to provide water to every part of the city and to extend its mains for that purpose. Heretofore the Spring Valley Company has refused to spend any money in extending its service in the growing districts, making the excuse that the income allowed by the rates was not sufficient to warrant the investment.

BERKELEY, CAL.—Initial steps toward the reduction of light and water rates in this city have been taken by the City Council, Councilman McClure taking up insistent demands from citizens that the rates now in effect be reduced, either through the establishment of a municipally owned light plant or through agreement with the public-service corporations. The Council also authorized a payment from the city funds of a sum of $1000 annually for representation on the San Francisco Engineers' Commission investigating the proposed improvement to the bay cities water supplies, including an examination of the Hetch Hetchy and Sierra supplies, with a view to enlargements to the services now being furnished in the cities of San Francisco, Oakland, Alameda and Berkeley. The conference committee of the allied improvement clubs of Berkeley has asked for a reduction in the price of water from $1.50 to $1; lights from 9c to 7c and gas from $1 to 90c.